

STITT'S DIAGNOSIS, PREVENTION AND TREATMENT OF TROPICAL DISEASES

STRONG



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OF

TROPICAL DISEASES

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SLCTION III

DISEASES CAUSED BY FILTRABLE VIRUSES, RICKETTSIAE, OR ALLIED ORGANISMS

Chapter XXIII

YELLOW FEVER

Progress in the study of yellow fever in recent years has been due par ticularly to the fact that a number of efficient workers have been willing to devote their energies for a period of years especially to the study of this disease. The danger of the spread of the infection especially through infected mosquitoes has made it imperative that experimental work be carried out in special laboratories and with proper precentions.

Dr A W Sellards has been conducting his studies upon yellow fever at Harvard University and abroad since 1973 and has become an outstand ing authority upon the subject Therefore it is especially fortunate that he has been willing to prepare the present chapter (R P S)

Introduction - Yellow fever is one of the more complicated of the infections of man but many of the essential features of the disease are well understood more especially the typical pathology the characteristics of the causative virus its behavior in man and in the mosquito vector many of the details of the mode of transmission by Aedes aegypti and the interesting effects which the virus produces in animals. Beginning in 1881 and continuing for nearly 20 years Tinlay conducted observations and many human experiments which led him to conclude that the aggs pti mosomito transmits yellow fever In 1898 Carter worked out the approxi mate limits of the extrinsic incubation period but with no thought of insect transmission Another period opened in 1900 when Reed Carroll Lazear and Agramonte by infection of volunteers demonstrated for the first time the essential features necessary for successful transmission by the mosquito A aegypts In their investigations concerning etiology Reed and his associates supplied convincing evidence that yellow fever is a virus disease. In 1928 mans laboratories undertook extensive experi mental investigation when the susceptibility of the rhesus monkey was reported In 1932 a procedure for the immunization of man was intro duced in order to utilize mass vaccination as a method for the control of vellow fever. In referring to the literature in this chapter it is not

feasible to include the many valuable articles of a confirmatory nature but a careful effort has been made to select the original observations. One may await with interest the developments concerning the existence of yellow fever in the wild life of the forests. Chinically the treatment of yellow fever remains in an unsatisfactory state in that no specific therapy is available once the infection has become established

Synonyms of importance -None

Designation in other languages Fievre jaune (Virus Amaril) Febbre Gialla Fiebre Amarillo Gelb fieber

Definition—Yellow fever is an acute infectious jaundice caused by a virus which in the typical epidemics of Gites is transmitted from man to man by the mosquito A acg pts Fatal cases show an extensive necrosis of the liver which tends to be mid zonal in its distribution Recovery is accompanied by the development of a lasting immunity

HISTORY AND GEOGRAPHICAL DISTRIBUTION

Historical -Carter (1931) attributes the first definite description of yellow fever to Lopez de Cogolludo in Yucatan in 1648 whereas one finds the first clear recognition of the disease in Africa in Schotte's account of the outbreak among the British troops in Senegal in 1778 However there is much evidence which indicates that Africa may have been the original home of yellow fever Presumably both the virus and the insect vector (A aggypis) were brought to the New World during the days of the slave trade. On entomological grounds, the aegypti mosquito appears to be an importation into the New World since there are many species of mosquitoes more or less closely related to 4 gery pli in Africa but there is no other member of the subgenus Stegomyia which is native to the Americas Carter (1931) a lifelong student of yellow fever concludes that the biological evidence though not conclusive is altogether in favor of an African origin and that the available historical evidence is entirely consistent with this view. In former years, senous outbreaks of Jellon fever have occurred in southern Europe and in the Americas United States has experienced numerous severe epidemics notably the one occurring in Philadelphia in 1703 another centering in Memphis in 1878 and that of 1905 in New Orleans but this is usually considered as the last one that this country need expect. The period is almost forgotten when with the coming of the summer months outbreaks might be expected in our southern states The opening of the Panama Canal caused for a short period some serious apprehension that the increased traffic across the Pacific Ocean might lead to the introduction of yellow fever in the The geographical distribution of vellow fever does not correspond with the distribution of its vector 1 degrets The Orient with its suscep tible population and its abundance of suitable mosquitoes has at all times remained free of yellow fever and for this good fortune no explana tion is forthcoming Dengue fever is carried by 4 gegypts in essentially the same manner as yellow fever and dengue is prevalent not only in Europe and America but also throughout the Orient

The data based on the clinical diagnosis of yellow fever indicated that the endemic foci were limited to a few restricted areas in West Africa and in South America. The application of a practical laboratory method of diagnosis revealed two wast endemic zones that had escaped detection. Theiler (1930), working in the Department of Tropical Medicine at Harvard introduced protection tests in mice. Convalescent serum even many years after an attack of yellow fever, neutralizes the virus specifically, and affords protection to mice against an otherwise statal infection. This immunity test was promptly adopted by various workers in England Belgium France and more especially on a very extensive scale by Sawyer and his associates in the Rockefeller Foundation. In Africa, the endemic zone was found to extend eastward more

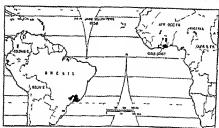


Fig. 198 -D stribution of Y flow Fever 1938 (Epidemiological Int Il gence Se vice of the League of Nations)

than 3 coo miles to the upper Nile with the Sahara Desert forming a barrier to the northward (Sawyer et al 1937). The second zone was discovered in Brazil along the Amazon basin (Soper, 1937) and includes important areas of some of the neighboring countries notably Colombia and Venezuela. In some unpublished observations Strong in 730 demonstrated the occurrence of yellow fever in Peru under sylvatic conditions. Some of the regions which have been recognized by immunity tests are frequently spoach of as silent force but this interpretation should be regarded with reservation. With increasing opportunities for clinical observation typical cases of yellow fever have been observed in some of these so called silent areas and fatal cases undiagnosed during their illness have been recognized at autopsy.

The potential menace of these vast endemic zones contrasts rather sharply with the recognized cases as shown in the accompanying map from the League of Nations

THE SPECIFIC ETIOLOGIC AGENT AND ITS I ROPERTIES

The fact that yellow fever is caused by a virus which readily masses bacteria proof earthenware filters was demonstrated convincingly in 1902 by Reed Carroll Agramonte and Lazear of the Army Commission in Cuba (Senate document 1911) and by Marchoux Salimbeni and Simond (1903) of the French Commission in Brazil No new evidence concerning filtrability was added until Findlay and Broom (1933) using Elford's technique of ultrafiltration assigned a probable size of 17 to 28µµ to the virus particles. The virus is sensitive to physical and chemical agents It is readily killed or at least rendered non infectious by drying by heat and the mical disinfectants. A temperature of 55 for 5 or 10 minutes is often sufficient to kill the virus (Reed et al Marchoux et al) Suspensions of virus in saline may become non infectious within 2 or 3 hours at room temperature but a little protein (10% of crum) will prevent this rapid deterioration (Bauer and Mahaffy 19,0) The virus is readily preserved in the cold and infective tissues remain virulent for many months if stored at a temperature a little below o C

The antigenic properties of the virus are evident inasmuch as immunity and a highly protective serum develops as the result either of an inappar ent infection or a serious illness. Much effort has been spent by several investigators on immunity reactions as 11/2 such as tests for precipitins and complement fixition. The results though of theoretical interest

have not achieved the status of a practical procedure

In the etia ogic era of bacteriology various microorganisms were described as the specific cause of vellow fever. Chief among these was Leptospira icteroides obtained in 1010 by Noguchi (1025) from cases in Guayaguil which he considered to be yellow fever. For nearly a decade this leptospira was accepted as a di tinct species and recarded as the specific cau t of yellow fever. This conclusion appeared to be adequately supported by the strikingly favorable re ults reported in serum treatment and in vaccination. More than 20 000 individuals were vaccinated with killed cultures of leptospira and the statistical data indicated pecific protection against yellow fever but these vaccinations may in fact have afforded protection against Well's disea e The author (Sellards 1927) concluded that yellow fever is not caused by any species of leptospira The me quite leder accepts does not transmit leptospira to man or to susceptible animals by its bite (Gay and Sellards 1927) L icteroides is identical with I icterohaemorringiae which in turn is a synonym of L saterrogans the name which properly applies to the recific cause of Weil's type of infectious jaundice (Sellards 10.10)

PATHOLOGY AND PATHOGENESIS

The yellow color of the scierae and the skin usually becomes quite distinct with the blanching of the skin after death. Haemorrhage into the stomach or intestines with extreme darkening of the blood affords a striking picture but this may also occur in leptospiral jaunduc. The

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liver about normal in size may be red from extravasation of blood or very yellow because of fatty degeneration, but the question of necrosis cannot be determined with any degree of satisfaction by gross examination

The essential lesion is a necrosis of the liver which in its earlier stages is frequently though not always midzonal in its distribution but this characteristic often becomes obscured by widespread molvement of the lobules comparable in some measure to acute yellow attrophy. The destruction of liver itsue affords an adequate explanation for the immediate cause of death. The pathology in rhesus monkeys (Macaca mulatta) is essentially the same as in man. Amorphous acidophilic degenerations were reported by Torres (1928) in the nuclei of the liver parenchyma

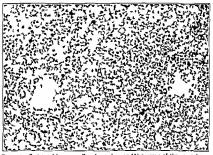


Fig 199 -- Section of I ver in yellow I ver showing (A) necros s of the pa enchyma × 715 (Army Med cal Museum ph to No 46958)

and these occur abundantly in the monkey and less frequently in man These nuclear changes have also been described and illustrated by Coodry and Kitchen (1930) and though not pathognomous they are of supple mentary value in diagnosis. At one period the identity of yellow fever in Africa and in America was brought into question but Tyzzer (1928) in the study of autopsy material from cases occurring in Senegal and Ecuador noted complete agreement in the pathological processes in both series of cases. Klotz and Belt (1930) reached a similar conclusion and they described some of the less striking changes in other organs such as granular and fatty degeneration of the kidneys degeneration and hyper plasas in the spleen and petechasl bambarorhages in the lungs. The degenerative changes in the musculature of the heart include the conduct in a system (LlOvd 1931).

Although the virus of yellow fever is highly neurotropic patients do not develop frank cerebral symptoms nor any extensive lesions of the central nervous system. The blood huan barrier is well developed in the adult but it is much less effective in children. If the central nervous system were maded by the virus the rapid necrosis of the liver might mask the more slowly developing lesions of the brain or conceivably a rapidly developing immunity might check the infection. These conceptions do not seem quite adequate and the marked neurotropism of the virus invites attention to the possibility of re investigating the symptoms and lesions of yellow fever especially in infants. The neurotropic virus of yellow fever when inconlated intracerebrally in the monkey leads to an acute disseminated encephalomyelists with nector is of the sensory and motor ganglion cells and the development of inclusion bodies (Good pasture roaz)

The virus presumably is obligately intracellular in its habitat but the site of the initial lesion and the tissues in which multiplication takes place is open to conjecture. Infective blood of monkeys may contain virus in dilutions as high as 1 to 50 000 000 or even 100 000 000 and in monkeys the virus penetrates cell free and almost protein free fluid such as the

aqueous humor of the eye (Sellards 1930)

Some of the features in the pathogenesis of yellow fever have an interesting bearing in regard to the symptomatology and treatment of the Rapid and extensive necrosis of the liver from any cause leads to abnormalities in the composition of the urine. During the epidemies of yellow fever at Dahomey and Dakar Pichat (1929) examined more than 2 000 specimens of urine During the first two days of illness the amount is usually abundant but the chlorides diminish rapidly the end of the second day albumin appears in traces and increases to as much as to grams daily. In severe cases peptones are exercted in the urme about the fourth day of illness and increase until death. In Dakar on ward rounds we frequently observed patients whose clinical progress appeared to be reasonably satisfactory but on visiting Pichat in his laboratory be could quite accurately predict a senous prognosis in those showing a marked peptonuma. The appearance of bile pigments in the urine was regarded as a favorable indication. The composition of the urme returns to normal toward the end of the first month of convalescence Pichat concluded that yellow fever can be distinguished from other infections by the composition of the urine

The rapid destruction of bepatic parenchyma leads to serious disturbances of the carbohydrate metabolism. The exizet chemical studies in experimental yellow fever by Waleman and Vorrell (1931) demon strated a hypogly caeman with regularity a depiction in the gly orgon of the liver and an impairment of its glycogene function. The hepatic leasons might alo lead to an increase in the guandine like substances in the blood and a slight increase has been reported in monkeys (Findlay and Hindle 1930) and in man (Berry and Katchen 1931). The changes in the values for blood sugar and guandine would be consistent with the muscular twistings and the gastic-intestinal lessons occurring in patients

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Fig. 199 -Section of I ver in yellow fever showing (A) necro: of the parenchyma × 715 (Army Med al Ruseum photo No 46958)

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secondary cases began to appear in rapid succession Of 46 people exposed at Gray Mansion 45 became infected. The one who escaped may have been an immune

With no thought of an insect vector the extrinsic incubation period was used in a himted way as the basis of a rational plan for the protection of persons living in communities where pellow fever had been recently introduced. Voluntary isolation camps were formed at a convenient distance from any active focus such as the one in 1859 near Jackson Mississipp. To he eligible for admission to this camp, applicants were trajured to come within a few days of the appearance of the first case of jellow fever in their community. Carter (1500) comments that no infections were expected in this camp and none developed.

At this point the investigations in Cuba were continued by a Commission of the United States Army namely Reed Carroll Agramonte and Lazear and it remained for them to bring exact proof of the role of the mosquito in yellow fever (Senate document 1911) All of the experiments were conducted on volunteers obtained chiefly from the United States Army and the Spanish envil population Finlay kindly supplied the Commission with a strain of Stegomyia mosquitoes with information about their babits and with the confident assurance that no other mosquito need be considered. The volunteers were isolated near Havana at an experimental station which was subsequently known as Camp Lazear after the death of Dr Lazear from yellow fever The first g men remained well after being bitten by mosquitoes which had fed on yellow fever patients. Dr. Finlay expressed full confidence in his conclusions and that some change in the experimental conditions would explain these failures. Fight of these o men had been bitten by only one mosquito with the incubation time in the mosquito varying from 2 to to days. In the next experiment Dr. Carroll who had been isolated except for two visits to the endemic zone was bitten on different occasions hy several mosquitoes and one of these had fed on an early case of veilow fever 12 days previously A severe infection developed ending in recovery and with this encouragement, the work was continued with volunteers kept in rigid isolation

Brethy, the Commission demonstrated that (a) the blood is infective for a morquite only during the first 3 days of a patient is illness (2) a period of approximately 12 days must elapse before the mosquite can transmit the infection (3) the mosquite remains infective for the duration of her file. These conclusions have stood the test of time and the only change has been the addition of detable of infermation. Thus the exact incubation time in the mosquite is dependent on the weather and may vary from 4 or 5 days at 37 C to as much as 3 necks at 20 C though the period of 22 days may be accepted as a reasonable estimate for ordinary conditions. Thus the extense incubation period of Corfe comprises the usual incubation time of nearly 2 weeks in the moquite plus the incubation period of a few days in man. The unique situation arises that the incubation time in the mosquite was estimated at Orwood with

MODE OF TRANSMISSION

The early literature contains vague suggestions concerning a possible relationship between insects climate and the spread of yellow fever In the epidemic of 1797 in Philadelphia Rush (1798) noted that on the nights of the 12th and 13th of the month (October), there was a frost accompanied with ice which appeared to give a fudden and complete check to the difease ' In 1881 Finlay commenced a series of investiga tions on the transmission of vellow fever by a specie, of Steromyia mos quito now usually designated as Aedes aegypia by 1900 he had conducted more than 100 experiments on volunteers of whom a small proportion developed vellow fever (Selected Papers 1912) Finlay concluded that A gegypti is the vector of vellow fever and advocated measures against this mosquito as a practical means of control, he noted also that even under apparently favorable conditions fomites appeared to be innocuous The e observations were published in the scientific periodicals of the New World of Europe and Great Britain but medical authorities in their efforts at control measures continued to concentrate their attention on formites and on disinfection Finlay's experiments were made under circumstances which did not exclude natural infection and moreover his conception of the mechanism of transmission by the mosquito was incom plete In the endernic area of Cuba there had been little or no opportun ity to observe and study the unexpected delay that occurs between primary and secondary cases In a region free of yellow fever various observers had noted that the introduction of an early case of the disease was followed by a period of about 2 to 3 weeks of apparent safety and then under favorable conditions secondary cases made their appearance in consider able numbers. This curious phenomenon remained unexplained since it was quite unlike anything known at that time concerning the ordinary infectious diseases Corre aptly designated this delay as the extrinsic incubation period a phrase which subsequent observers have frequently attributed to Carter The limits of this extrinsic period were worked out with considerable exactness by Carter (1900) at Orwood Mi sissippi and his description of this locality illustrates the exceptionally fatorable circumstances which arose for this classical study in epidemiology

Orwood is rot a ton, or even a hands-t-st is a neighborhood —an agricultural committy about is make itom the radmand at Taylor consisting alous textusively of white people is the on their farms actions closer than a smile apart working their on hands the strength of the

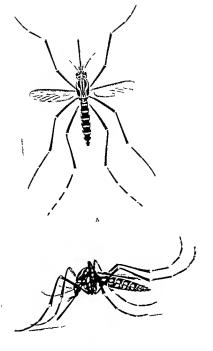
One case of vellow fever of only moderate seventy was introduced at Gray Mansion one of the homes at Orwood A week passed uneventially the members of the household remained well a second week passed and the incident was almost forgotten After an interval of 18 days

considerable exactness without recognizing that the infection was transmitted by insects. The infiliant results of anti mosquito campaigns in Cuba and in the Americas led eventually to a plan for world wide rendication of yellow fever and this difficult undertaking achieved a remarkable measure of success under the auspices of the Rockefeller Foundation with results of permanent value in cities of North and South America. The available evidence from experimental and from epdemiological sources indicated at this period that the virus of yellow fever in nature is limited quite strictly to man and the one species of mosquito Actes: acpypti. However in Great Britain Fowler and his associates (1966) had emphasared the necessity of looking for vectors other than A acpypti and for infections occurring naturally in lower animals a view soons which has examed ground in recent vests.

Many species of mosquitoes transmit yellow fever by their bites from monkey to monkey under experimental conditions Within 4 years after the recognition of the susceptibility of the rhesus monkey Hindle (1933) in reviewing the literature listed 13 species of mosquitoes in West Africa as transmitting the virus by their bites in a more or less effective manner Nine of these species befonged to the genus Aedes the other genera being Eretmopodites Culer Mansonia and Anopheles Other species and even other genera have been added to this list notably three species of Aëdes and one of Haemogogus in South America A geniculatus in France and 1 albapictus in the East Indies (Sawyer 1930) neoartic mosquito A triserialus occurring entirely outside the endemic zones of yellow fever transmitted the infection experimentally but not in the efficient manner of 4 aegypts (Bennett et al 1939) In some instances doubtful or conflicting results have been reported by investigators using apparently the same technique Successful transmission by various kinds of mosquitoes under artificial conditions of the laboratory does not in itself imply that these species are of epidemiological impor Indeed i aegypt: remains as the vector responsible for the extensive urban outbreaks of yellow fever The search for other vectors has proved to be a time-consuming undertaking. Thousands of mos quitoes caught in the forests of Brazif were allowed to bite rhesus monkeys and the virus of yellow fever was demonstrated in two genera Aedes leucocelaneus and Haemagogus capricornii (Shannon et al 1938) An even more difficult task has been encountered in the search for an animal in nature which might serve either as a susceptible host or as a reservoir for the virus The hedgehog has been considered because of its susceptibility to yellow fever (Findlay and Clarke 1934) The blood of monkeys from endemic zones of yellow fever occasionally affords protection to mice (Findlay et al 1936) Similar results have been recorded by Soper (1936) and others

EPIDEMIOLOGY

The mode of transmission of yellow fever affords a reasonably clear understanding of its epidemiology In the extensive epidemics of cities



Pig 200 — Atter ortyphi Penske Dortal vew ad usu l potur when reting (From Goeld! On Monagation a Pri Pai 1905)

Sign

primary cases the possibility of a sylvatic focus deserves some conaderation though there is no evidence that yellow fever exists in the forest regions of this country at the present time. West Africa presents some difficulties in epidemiological studies concerning sylvatic foci of infection but the results of investigations there will be awaited with interest especially in view of the opinion that Africa is the original bome of yellow fever. Some day information may become available which might indicate whether yellow fever is essentially a disease of lower animals with periodic outbreaks in man or whether the virus has possibly since its introduction to America, escaped from its cycle in man and the aegypti mosquito to establish itself in other species of vertebrates and arthropods

Symptomatology

It is customary to state that the incubation time of yellow fever varies from 3 to about 6 days in one instance a period of 13 days was noted by Marchoux et al (1903) There is much individual variation in the sever ity of the course of the disease with many gradations between the mild and the serious cases. To refer to the devastating epidemic of 1707 in Philadelphia Rush (1708) emphasized that There were cafes of this fever fo light that " " " such persons walked about and transacted their ordinary butinets In 1028 this observation was confirmed experi mentally when the virus of yellow fever was recovered from patients who developed merely febricula of a few days duration. During an epidemic yellow fever patients present symptoms and signs which are almost clinically diagnostic in the severe cases. With slight prodromata often during the night the temperature rises moderately the pulse and blood pressure increase and the patient experiences chilly sensations headache rachialgia and the attending discomforts of fever. The characteristic signs of the infection begin to appear early in the course of the disease Changes in the urine may occur late in the second or during the third day Albumin is found at first only in traces but it may increase so rapidly within a day or two that the name almost clots on boiling. A tentative diagnosis of yellow fever is justified in these cases which show this rapid increase in the albumin content of the urine Casts are usually found in abundance The volume of usine tends to decrease and obguria may become a serious factor

The temperature remains only moderately high but as the fever reaches its fastignum the pulse rate fails and this disproportion between the temperature and pulse is known as Faget's sign. The myocardial changes rather than the slight or moderate jaundice may quite conceivably be the significant factor responsible for the slowing of the pulse rate. Prostration is an outstanding feature and its severity seems out of proportion to the temperature and general condition of the patient. Well marked prostration rather than the classical symptoms of yellow fever was an important feature in the climical diagnosis of a moderately severe case in Senegal from which the French strain of virus was obtained.

the infection is spread tapidly by the vector A aegypii. In some of the former endemic foci such as Cuba the virus was maintained continuously in man and the aegypti mosquito with no indication of any other vectors or of infections in lower animals. This midde of transmission involves a delicate balance of factors which at times seems barely sufficient for maintaining the existence of the virus. Thus it is necessary that susceptible individuals must be available, the blood of the patient is infective only for a few days, and the life of the mosquito is short perhaps in nature about one month. In some of the islands of the West Indies yellow fever disaponeared spontaneously.

Frequently evere and even fatal cases of yellow fever, if they occur in sporadic form, are not diagno ed correctly the disease remaining unrecognized until it reaches epidemic proportions. In communities opposed to autopsies an instrument described as the viscerotome has been introduced for puncturing the abdomen of the cadaver and removing a portion of liver for histological examination. This procedure is hardly less objectionable than an autops; in regions were any postmorten exam mation is regarded in sincerity as a violation of the dead. In Brazil the viscerotome service has required the support of legalization by execu tive decree The technical organization of this service has been described in detail by Rickard (1037) and the difficulties have been emphasized by Rickard and also by Soper (1937) Thus it is customary to pay the lay man performing viscerotomy in proportion to the number of samples submitted. At times multiple specimens from one person dead of vellow fever have been sent under several fictations names and occasionally liver tissue of lower animals including avian species have been received by the pathologist. The outstanding advantages of the service to the epidemiologist are evident from the experience of Soper Lickard and Crawford (1934) The examination of more than 28 000 specimens of liver collected chiefly in Brazil established the diagnosis of yellow fever in 54 cases, and 43 of these came from localities in which the presence of vellow fever had not been recognized

The experimental evidence concerning the existence of sylvatic yellow fever is meager but epidemiological observations in South America indicate that endemic zones of infection exist in forest regions where sporadic cases occur in the absence of A aegypti (Soper et al. 1933). Obviously the infection cannot spread to the small communities near the edge of the forest when these are located in areas virtually free of any vectors of yellow fever. Such indemnity against vectors is not always enjoyed and Burke (1937) has de cribed an outbreak of 201 cases occurring in the ab ence of A aegypti. Danger from another source may arise when a patient infected in the forest visits a community where aegypti mosquitoes are present and an autherak of this nature has been recorded (Walcott et al. 1937). Looking backward, one readily excells expediences of vellow fever in which the origin still remains unexplained. In 1935 under the original production of the still remains unexplained. In 1935 under the original still remains unexplained. In 1935 under and Blai dell reported 56 cases in San Salvador far removed from any known focus of infection and without any recognized importation of

by the infection of experimental ammals. Immune bodies develop rapidly and may co exist with virus in the blood but a fatal termination may ensue even in the presence of neutralizing antibodies. Under epidemic conditions the majority of deaths occur during the first week of the disease as illustrated by the accompanying table from Hanson's record (1929) of the Peruvian outbreak of 1921.

TABLE SHOWING DAY OF ILLNESS ON WHICH THE GREATEST NUMBER OF DEATHS OCCURRED

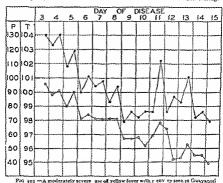
Day of death	Number dying this day	Day of death	Number dying this day
and	4	r2th	3
3rd		r3th	3
4th	23	r4th	2
sth	9 1	r5th	1
6th	52	róth	1
7th	31	r8th	1
8th	T4	20th	1
gth	1	23rd	3
roth	1 , 1	24th	1
rith	8		}

Relapses are rare and convalescence when once established ordinarily preclambeds rapidly without indication of any permaent damage to the myocardium and without any tendency to the development of complications such as a contracted kidney or cirrhosis of the liver. It is quite conceivable that no extensive destruction of hepatic parenchy ma occur in patients who recover and who show only a sught degree of peptonuma. This interpretation is distinctly at variance with the conclusions of Klotz and Belt (1930) who emphasize that complete and scarless healing of the liver and kidney occurs although these organs must have suffered appreciable damages after ever a brief but Vincual attack of vellow feet.

SUSCEPTIBILITY OF MAN AND LOWER ANIMALS

Dung an outbreak of yellow feer there is evidence of much individual variation in the severity of the infection but the question of racial variation is admittedly difficult. The facts at hand do not permit final conclusions concerning all of the details that are involved but the working basis for the epidemiologist is clear. In Africa, yellow fever has long been considered as a disease of the white race and the negro has taken little interest in control measures but the fallacy in this interpretation her in part in the middices of the symptoms sometimes observed in children though this feature has been somewhat over emphasized. However in endemic zones many of the native children develop unrecognized infections and as adults their immunity during an outbreak has been attributed to natural resistance. The error of this scondusion has been

Jaundice and evidence of haemorthages may be expected as early as the fourth or fifth day of siless though ordinarily the jaundice is not intense, even in socrec cases. The gums tend to bleed easily on pressure and frank haemorthages may occur in the stomach and intestine accompanied by epigatine pain. The stomach contents may consist chiefly of blood which almost invariably turns black giving rise to the so called coffee ground. Ownities and the patients recognize that this omnious sign may foreshadow the end of their filmes. Subcutaneous harmorthares



Ecuador through the countery of Dr. Wene slao Perega on the core on of the expedition from the Harvard School of Trop at Med cine to South America n 1913. The pulse s moderately rapid easily a the course of the disease but the rate shows progress we slowing as the infect on reaches and passes it fast g um

occur only exceptionally and they may appear as petrchus or as patchy eachymoses. Patients tend to remain clear mentally and often become annous and alert as the symptoms increase in seventy. After a few days of illness the temperature falls in a small proportion of cases the symptoms term and a period of calm sets in lasting at times only for a few hours after which the temperature rises again, producing a saddle back or bactrain chart.

Even during epidemics of exceptional seventy a considerable proportion of cases recover. Some of the higher estimates of mortality approach 75% or even 80% but it would be difficult to obtain accurate data which include the mild cases that are difficult of diagnosis except by the infection of experimental animals. Immune bodies develop rapidly and may co exist with virus in the blood but a fatal termination may ensue even in the presence of neutralizing antibodies. Under epidemic conditions the majority of deaths occur during the first week of the diseases as illustrated by the accompanying table from Hanson's record (199) of the Peruvian outbreak of 1921.

Table Showing Day of Itlness on Which the Greatest Number of Deaths Occurred

Day of death	Number dying this day	Day of death	Number dying this day
20d	4	rath	3
3rd	9	r3th	3
4th	23	r4th	2
5th	30	15th	
6th	52	r6th	r
7th	21	18th	1
8th	14	20th	1
gth	17	23Id	3
roth		24th	
rith	8		}

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illustrated quite clearly in our southern states where negroes growing up in this country appeared to empy no racial protection and the epidem sologist is confronted with the difficult task of finding and diagnosing mild cases instead of adopting the easy assumption of ramal insuscentibil ity The importance of the negro race in maintaining and spreading the infection was emphasized in Dakar where the French authorities quite commendably called the first international conference for coordinat ing the efforts of various countries in the study and control of yellow fever (Conférence Africaine 1929)

Extensive search has thus far failed to reveal natural infections in lower animals accompanied by typical signs and symptoms though the demonstration of protective substances in the blood of some soccies of monkeys presupposes inoculation of the virus attended at least by an mapparent reaction. The behavior of lower animals upon inoculation with the virus of yellow fever requires consideration of a wide range of susceptibility varying from entirely mapparent effects to the development of fatal infections which in some cases may be quite similar and in other circumstances quite different from the disease as it occurs in man be sufficient to describe characteristic examples of the various types of

reaction without a detailed discussion of each species

The rhesus monkey (Macaca mulatia) develops symptoms and lesions that resemble closely the human disease (Stokes Bauer and Hudson 1028) Under the severe conditions of laboratory experimentation the mortality of the monkeys is extremely high (og to 100%) and at times nearly all of the parenchyma of the liver may be necrotic. The French strain of yellow fever was obtained in Senegal (Mathia Sellards and Laigret 1928) and if so desired, its virulence may readily be maintained at such a high degree that virtually all the inoculated monkeys will run an acute and fatal course Infective liver from a monkey dying of yellow fever was transported in the frozen state from West Africa to London and subsequently to the United States this being the first strain taken out of Airca Much of the experimental work on yellow fever in the Institutes of Europe and America has been conducted with this strain either in its ordinary or its neurotropic form M sinious is less susceptible than the rhesus monkey and curiously enough, the chimpanzee appears to be markedly refractory to vellow fever

The marked neurotropism of yellow fever virus is readily demonstrated by the intracerebral injection of the white mouse whereupon a fatal encephalitis ensues but without necrosis of the liver In the accompany ing illustration one notes the rough hair the Lyphosis and just postenorly the line of constriction resulting from interference with respiration Paralysis of the hind legs and also of the tail is virtually complete As a routine virus is injected in the frontal lobe and becomes disseminated throughout the brain and cord The frequency with which paralysis in vellow fever and in some other neurotropic infections appears first in the hind legs under these conditions has not been fully explained by the neurologists Theiler at the Harvard Medical School (1930) established

a neurotropic strain by repeated intracerebral passage of the virus in mice the neurotropism becoming somewhat enhanced but with a loss of the ability to produce serious hepatic lesions in the monkey or in man With repeated passage of the virus m mice the course of the disease is shortened and death may occur as early as the fifth or sixth day. The intrapentioneal injection of white mice with unmodified virus produces a fatal encephalitis in a small proportion some are immunized and others remain susceptible (Sellards 1935 a). At the suggestion of Andervont new born mice were injected intraperitoneally with ordinary virus and a fatal encephalitis developed just as in the adult mice injected directly



Fig. 202 - Enceph lt : n whit Swi m u e dev l p g the s v nth d y after ntr c reb linge t on of th viru f y ll w fev f om the 404th pastage n m c

into the brain Encephalitis follows the intracerebral injection of various rodents and several species of monkeys which remain well after ordinary routes of injection

The monkey (M mulatia) reacts in an interesting manner with regard to the intracerbent and the extraneural impection of the virus of yellows to the intracerbent in method in the virus of yellows. After intracerbent impection of neurotropic modification (Sellards, 1937) After intracerbent impection of neurotropic runus a fatal encephalinis usually ensues without isoundice or bepatic lessons whereas the subcutaneous impection of the neurotropic modification produces as a rule only a mild infection with immunity. The ordinary virus though it possesses marked neurotropic affinities fails to produce encephalitis upon intra cerebral impection but the animals due in a few days with necross of the liver before there is adequate time for the development of the cerebral lessons. An important observation has been contributed by Penna (1936) lessons.

injected there intracerebrally with yellow fever virus in its ordinary form. Under these ci-cumstances exceptabilis developed but the immune serum protected the liver from any extensive degeneration.

There are a considerable variety of species which develop only an imapparent infection when inocusted estimaterially with the ordinary virus of yellow fever. Thus in the guince pay the virus was transferred sensily from one animal to another at intervals of 5 to 7 days by intra-perticular injection without the development of symptoms or lessons.

THE USUAL BEHAVIOR OF THE CRIMNARY AND OF THE NEUROTROPIC VIRUS OF VELLOW
FEVER IN VARIOUS ANNALS

Veus I Rout of y Now fev priest n	Rout of		Lesso s		R ult
	An mai	Eav	Ban		
D quash	E t annu si Int ac ebrai	Monkey (35) crous	N a No	D is D is
h ur tropi	Estran or 1	* I #)	h e	Nou Bapřt	In pps nt f t n and immunity D gth
Ord a Ty	E tran r i Intra er bral	17 £	h n	N Ecphit	Sinc ot blity mm tys Do th
h rotros	E t neu al I t a rebral	mou e	Non None	l. E c pbalt	S teeps bity o ram n sy D sh
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Neu 1 p	Etrnur1 Itr rbal	Gu pg	N e	h n E ph l i	Imman is D sid
Odsy	Exc ages al		N 670		Death
h s t pc	E t new sl	Hedg hog		En eph bt s Enc phalt	D ath D th
O d nary	lug ton	Mosq to		N ne	V ru m lt pl

Small paren 1 ge of e ephal tes

Some m nontept Me adom a cumme 4
From th Symp m You ad M has 3D m es (940) by so leay fith If ro 5 Un
the Frest

Some blood and speen from a guinea pig of the third passage was injected no a monkey and death from yellow fever occurred on the third day (Sellards 1930). The neurotropic strain upon intracerebral inoculation produces a latal encephalitis in guinea pigs (Siefamopoulo and Wasser mann 1933). Several species of animals notably cebus monkeys the ferret, the rabbit and the hen develop a protective serum when injected with the virus ints ordinary form (Sawyer and Frohisher 1930) and

the infection of chiek embryos has been described by Jadim (1937) and by Elmendorf and Smith (1937). The data concerning the more important types of reaction are illustrated in the table on page 888.

Various species of arthropods may harbor the virus of yellow fever without transmitting the infection when feeding on a susceptible animal but only when crushed and injected subcutaneously in monkeys or even intracerebrally in miee. The many species of mosquitoes which serve experimentally as a vector show no injurious effects from the presence of the virus Relatively little has been added to the basic facts reported by the United States army commission in 1900 concerning transmission by the aegypti mosquito Virus may be demonstrated in mosquitoes at any period after an infective feeding by grinding and injecting the insects into a monkey (Davis and Shannon 1030) and there is no indication of any developmental cycle The optimal temperature for the growth of the virus may be determined with considerable accuracy by noting the incubation time required at different temperatures before the bite of the infected mosquito becomes dangerous Briefly one could be bitten with impunity by infected mosquitoes kept continuously at 10 to 15 C (Hindle 1010) but at 17°C the meubation time is shortened to a few days just as in man instead of the classical period of about 12 days at room temperature (Sellards 1930) This experiment justifies the con clusion that the virus multiplies in the mosquito (Sellards 1038) and additional confirmation was supplied by Whitman (1937) who used other methods of experimentation. Valuable data concerning the effect of temperature on the incubation time in the aegypti mosquito were supplied by Davis (2012) but with the erroneous interpretation that no multiplication of the virus takes place in this host (Davis Frobisher and Lloyd 1933) Precise information is lacking in regard to the exact nature of the events that take place during the incubation period. The rather unwar ranted assumption has been offered that the virus injected by a mosquito must of necessity come from the salivary glands. In dissecting these glands to test their infectivity they may easily be contaminated with tissues of the mosquito known to be nich in virus. In a few experiments we found no virus in traces of coclorus fluid drawn off by thoracentesis from infected mosquitoes There is no evidence of any specific micro organism nor any reaction or lesion in the tissues and even serial sections fail to distinguish infected from normal mosquitoes

TELINICAL PROCEDURES

The customary hacterologie technique should afford adequate protection for working with animals infected with yellow fever. Virulent strains induce a rapidly fatal disease in the rhesus mookey, though quite exceptionally some individuals remain apparently well for a few weeks and then die suddenly the anatomical lessons being typical of yellow fever with no indication of any chronic process. Occasionally some monkeys show no definite febrile reaction but develop a significant degree of malaise and death may occur within 3 or 4 days after inoculation.

Fortunately the maintenance of a strain of virus in the laboratory does not require continuous passage in animals since infective fissues retain their virulence when frozen (Selfands and Hindle 1028) As a routine procedure it is neither necessary nor advisable to dry the frozen tissue, some laboratory infections having been attributed to accidents in handling virus in the form of a dry powder

The mosquito A asympt lives by preference in the home, and with but little change in its u ual habits colonies may be maintained readily in the laboratory. On no occasion do us follow the practice of introducing a monkey into a cage of mosquitoes. On the contrary the animal is held outside of the cage against the wire creen and the mosquitoes bit readily through the meshes. The special trap illustrated in the accompanying figure permits the removal with perfect safety, of a few mosquitoes from a cage of inflected ones in case some are desired for special study. The manupulation of this trap is altogether simple and its use has been described in detail (Selfards 193).

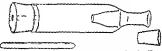


Fig. 203 -Trap for handling infect d mosquitoes (H actual 2.2.) (Reproduced by courte y of the Naverly Pres. Balt more)

Protection Tests -By exact experimentation on man Marchoux Salimbeni and Simond (1903) demonstrated that the virus of yellow fever is neutralized by the serum of convalescent patients. In a similar manner the protection of rhesus monkeys was demonstrated soon after the discovery of the susceptibility of this species Hindle (1930) noted the protection of monkeys by the serum of a patient 24 years after recovery from vellow fever there being no opportunity for re exposure during this long period Theiler (1930) substituted mice for monkeys using intracerebral inoculations. This severe route of injection remuts the u e of only minimal amounts of serum. Nevertheless this method with some modifications proved quite satisfactory for testing the protec tive action of the erum of persons vaccinated against yellow fever (Sellards and Laigret 1932 c) A valuable medification of the test was introduced by Sawyer and Lloyd (1931) the injections of serum and virus being made intraperitoneally, with traumatization of the brain by the injection of starch paste to facilitate localization of the virus Tiberal amounts of infective mouse brain are triturated and injected but it seems preferable to centrifuge the su pension and use only the supernatant fluid (Sellards and Bennett 1937) Mice dying on the 4th or 5th day of neurotropic yellow fever are sacrificed and a 15% or 20% suspension of a highly infective brain is prepared in physiological saline containing 10% of normal serum The tissue is removed by centrifuging the super

natant fluid is rich in virus and the control mice will die with regularity Starch paste or distilled water is impected intracerbrilly in mice in groups of 6 for each serum to be tested this being a convenient number on, mally adopted by Theller Then equal parts of the suspension of virus and of the serum to be tested are mixed and injected intrapersionally without preliminary incubation using o 5 cc of the mixture. The majority of the mice which are not protected due about the 6th or 7th day though quite exceptionally an occasional death may occur even in the third week, after injection.

The specificity of the protection test in mice has received critical examination through a period of years by reason of the many thousands of human sera that have been examined in outlining the endemic zones of yellow fever. There are only a few instances of apparently failse reactions where protection has been afforded by the serum of a person who could in no way have been exposed to yellow fever. Peltier et al (1931) have advised caution in the interpretation of tests made with sera containing bile pigments and bile salts since the virus of yellow fever is sensitive to the action of bile. The specificity of the test when applied to lower animals requires individual consideration of each species Attention is invited to the protection afforded by normal serum of sheep (Findialy et al 1936 and South 1940).

A survey of immunity in the various age groups of a given population may enable one under favorable circumstances to reconstruct the history of yellow fever in the community with considerable evactines. This may be illustrated readily by an instance where one is able to compare the historical data with the results of an immunity survey. Thus one may be able to distinguish between active foct of infection and others which have hecome extinct such as the endemic zone which formerly ensisted in Cuba. The last outbreak in this island occurred in 1905 and persons born after that date bave no immunity to yellow fever as determined by Drotection tests.

MODIFICATION OF YELLOW FEVER VIRUS

The virus of yellow fever has been modified not only by intracerchral passage in mice but also by continuous cultivation is strive in surviving itssue. In either case there is a loss of the ability to produce hepatic inecross but with persistence of the neurotropic properties. The interpretation that these two characteristics can be varied at will by laboratory procedures requires some qualification since no strain has been developed which produces typical symptoms of yellow fever in the rhesus monkey with failure to cause encephalists in mice. Actually the essential feature is uniformly in the direction of a loss of the tendency to destroy the liver parenchyma with occasional reports of reversion to the natural virus. The incurrency of the produces injection in man and virus appears in the blood stream (Schlards 1937). The ordinary virus of yellow fever has been designated by various terms such as "secretoripoe hut viruses".

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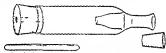


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ordinary virus died This is of especial interest since the ordinary virus is highly neurotropic

In nature strains of yellow fever from various sources appear to be reasonably constant in their immunizing power but show variation in their irrulence for the rhesus monkey. No virus infections are known which show any close relationship to yellow fever in the sense of any overlapping in immunological reactions. In this respect dengue fever has attracted much attention more especially because of its mode of transmission by A eegypts. The careful investigations of Shudders Postums and Schuffer (1934) failed to show any immunological relationship or any indication of etiological simularity between dengue and yellow fever.

VACCINATION

Specific prophylatus against yellow fever was regarded at one time as quite unnecessary or even undesirable since prevention of the breeding of aegypti mosquitoes appeared to afford an efficient and almost an ideal method for the control of epidemics. However in each outbreak many lives are lost during the weeks and even months that elapse before the measures against the mosquito become effective and no practical methods are available as yet for avoiding or controlling the vectors in sylvatic regions

The virus of yellow fever behaves in a manner that simplifies consider ably some of the problems involved in the development of an appropriate method of vaccination. Even a mild infection results in a substantial and lasting immunity. For practical purposes it is fortunate that strains of virus from widely separated regions afford mixtual cross protection (Theiler and Sellards 1928). Immunication with fifeless vaccine is only in the experimental stage (Findlax and MacKenier 1926). Repeated injection of rabbits with non-infective virus resulted in a measurable degree of immunity (Sellards and Bennett 1927) the results being

improved by the addition of cysteine for the protection of the labile antigen (Mudd et al. 1027)

anaged (audot et al. 1937)

In practice one injection of lw.ing wrius is used for the immunization of man with the expectation of producing a mild or inapparent infection A method for mass vaccination for the control of yellow fever was developed in 1932 using a neurotropic virus maintained by intracerebral passage in mice (Sellards and Larget 1932 a-b-c). Investigation of the effect of neurotropic virus on man was approached with caution using preliminary injections of infeless vaccine followed by the subcutaneous injection of an extremely bigh dulution of infectious mouse brain. No local or general reaction developed either to this injection or to subsequent inoculations of increasing amounts of living virus but an immunity developed as indicated by successful protection of mice using the severe intracerebral route for the injection of virus mixed with minimal amounts of serum. The margin of selfety of this procedure for vaccination of man was tested in one instance by using a moderately low dulution of virus for the initial mection. There were no appreciable subsective symntoms

are characterized by an affinity for certain types of cells rather than for the various viscera and the significance of tropism is lost when applied as a pantropism. For all cells Preuse terminology for the ordinary strain must await further developments but the phrase 'natural virus of yellon fever (Lloyd and Mahaffy 1936) is unmistalably clear and satisfactory. Unsepteded confusion has arisen in the consideration of some of the modified strains. Endlay (1934) suggests that the neuro tropic virus maintained in mice should in fact be regarded as pantropic since it is not strictly neurotropic. In another unstance, a modified

viscerotropic virus proved on examination to be a strain which after long cultivation by Marthard technique fails to produce visceral lesions but continues to cause a fatal encephalists on intracerchial nijection Briefly this conforms to the prevailing conception of a neurotropic strain

The ordinary virus cultured for three years in a two on surviving tissue gave rise to the modification designated in the literature as "17 D On intracerebral injection in monkeys this strain produces an encephalitis followed by recovery but in mice a fatal encephalitis occurs in about seventien days. There is therefore no doubt about the neurotropism of the culture known as 17 D and in the subsequent section on vaccination it is designated for the sake of clearness is a cultural neurotropism modification. The changes which the ordinary urius undergoes upon cultivation in tito are of much interest and the mechanism of these changes seem obscure. Gordon (1940) concluded that the type of it sue used for cultivation determines the nature of the changes but the evidence i

There is room for difference of opinion concerning the possible reversion of neurotropic to the ordinary form of virus of sellow fever. First of all it is important to note that none of the modifications have been maintained for long periods comparable, for example, to the many years that the fixed tirus of rabies has been transferred from rabbit to rabbit. The French neurotropic strain of Jellow lever after about 200 passages in mice was injected into the liver of rhesus monkeys and the strain regained its original properties according to the observations of Findlay and Clarke (1035) This result is of much theoretical importance and deserves confirmation Findlay and MacCallum (1938) reported spontaneous reversion of the neurotropic strain and this important observation also awaits confirmation. In one instance the injection of a baboon with neurotropic virus was interpreted by van den Berghe (19,9) as resulting in reversion of the virus to its ordinary form but a final conclusion may he left to await a critical review of the criteria employed for describing and determining reversion. In practical experience with vaccination over a period of eight years no difficulties have arisen from reversion of neurotropic virus to its natural state

An interesting protective action has been described by Hoskins (1035) who noted that rhesus monkeys survived when injected with both neuro tropic and with ordinary virus whereas controls injected with only

the nature of these reactions The virus of yellow fever was not recovered from the blood or spinal fluid of any of these cases but it may quite con cavably have been present in the central nervous system. In one patient a complicating infection was due to the virus of lymphocytic choriomeningitis which evidently was present in the mouse from which the vaccine had been prepared (Laigret and Durand 1936) The literature emphasizes one fatality but this occurred after an interval of one year and two months without definite evidence of any relationship to the vaccination

Peltier et al (1940) have introduced a technique of exceptional interest which consists in scarifying the skin with a mixture of virulent neuro tropic yellow fever virus and the virus of vaccinia no severe reactions being observed even in infants The simplicity of the method permits its rapid application and 98 873 persons have been vaccinated in this way Protective substances against yellow fever developed in the serum of or 6% of r 387 cases the serum being strongly protective in 80 6%

The neurotropic strain of yellow fever is not readily transmitted by aegypti mosquitoes (Sellards 1931) though occasional successful results have been reported experimentally (Davis et al. 1032) During the course of vaccination virus may be present in the circulating blood and Sawver with his associates (103) have discussed the possibilities of an outbreak of vellow fever originating from vaccinated persons. There is no reason to suppose that transmission of virus by mosquitoes has occurred during the many vaccinations that have been practiced in Africa and there is no indication that the neurotic strain tends to revert in the mosquito to the ordinary virus

A complicated process described as serovaccination was investigated by Sawyer and his associates (1032) for the protection of their staff many accidental infections having occurred among their laboratory personnel In principle the injection consists of liberal amounts of neurotropic virus which is underneutralized with specific immune serum. Ordinarily a mild infection results and the serum shows neutralizing bodies for a period of a year or so Serovaccination has only a limited field of applica tion and the procedure is accompanied by some risk of complications involving the central nervous system (Darre and Mollaret 1936) similar case of encephalitis following serovaccination was noted by Sawyer (1937) Jaundice of unknown etiology developed within two to eight months in 20% to 30% of a group of persons receiving serovaccination (Soper and Smith 1938) The use of neurotropic virus without immune serum has been opposed more especially by Findlay (1934) in England and by Theiler and Whitman (1935) in this country though no other plan of mass vaccination was available and they do not report any experience with its application in man Gordon and Hughes (1936) cite Theiler and Whitman as questioning the safety and quite erroneously state that Findlay (1934) questions the efficacy of vaccination by neurotropic virus maintained in mice. It would seem paradoxical to consider that a severe reaction in yellow fever would nevertheless fail to produce immu

but the temperature rose to 35° on the sixth and seventh days accompanied by a bradycardia with a trace of albumin in the urine. The first tests on a large scale were conducted with a cautious plan of using 3 injections at intervals of 20 days. In Senegal, more than 3 000 rolunteers were vaccinated in this way in the summer of 1934 by Largett who emphasized that two of these volunteers developed serious symptoms of myelitis and meningiti followed by complete recovery. By the end of the summer of 1935, the vaccinations in French West Africa had reached 2, 360 injections the greater part of these representing three inoculations for each individual (Mathas et al., 1936). The next step in amplification of the technique consisted in suspending the virus in egg 30lk to delay its dissemination and using only one injection of vaccine (Nicolle and Largret 1935).

The efficacy of this method of vaccination has been established by the results of its practical application in endemic zones of yellow fever and by experimental investigations. Small amounts of the serum of vaccinated persons protect monkeys and mice against excessively large quantities of virus. This protective action affords suggestive evidence but not exact proof of the immunity of the individual However a member of the staff nearly eight months after routine vaccination developed no reaction when bitten by inferted mosquitoes though normal monkeys bitten by these mosquitoes died of yellow fever (Sellards and Laigret 1016 a-b) This demonstration influenced favorably the Commission of the Societé de Pathologie Exotique in Paris in recommending voluntary vaccination for communities in Africa exposed to yellow fever (1936) for protective immunization was urgent and there was no need to make vaccination compulsory The following unpublished ob ervation illustrates the persistence of protection over a long period. An individual who received one injection of infective mou e brain experienced almost no symptoms but five years later his serum in a dilution of r to 50 pro tected 5 of 6 mice against yellow fever using the intraperitoneal route of injection Peltier (1018) summarized the results of 4 years' experience in vaccination for the control of yellow fever in French West Africa and he recommends attenuation of the quarantine procedures for those who have been succes fully protected Tests were made at varying intervals to determine the duration of immunity the longest period being 3 to A years after vaccination The serum of 3x cases was examined at this interval and 6 afforded strong protection for mire whereas 4 gave feeble protection and 2 resulted in failure A sufficient period of years has not yet elapsed for determining the maximum duration of the immunity that may follow this method of vaccination. In working on a large scale occasional failures are to be expected One of the 3 coo volunteers accurated in Senegal in the summer of 1934 developed yellow fever two years later in an endemic zone in Africa and the infection terminated

The cases with symptoms of involvement of the central nervous system have been reviewed in full by Laigret (1936) Opinions differ concerning

slight risk for the assurance of adequate protection but a method which from time to time leads to a sense of false security tends to undermine the confidence of the community. The cultural strain is especially useful for exceptional circumstances where individuals remain under observation the results being determined by protection tests with repetition of the injections till immunity is established. Neurotropic variants of yellow fever are under investigation in several laboratories for the purpose of obtaining still further improvements in the technique of vaccination. Pelitier et al (1937) have investigated the immunizing effect of neurotropic yurus mixed with minimal quantities of bile.

The enterns for the ideal method of vaccination against yellow fever have been defined by various authorities emphasizing the welfare of the individual and also the danger that the reaction developing during immunization might accidentally set up an epidemic among the univace cinated. It would seem within reason that a person volunteering for vaccination abould expect to obtain adequate protection and also expect that the resulting immunity implies ender at least for the birt period of a few years. Much progress has been made in this direction in a rather brief period of time but one hopes and expects that distunct improvements will be made in any of the techniques which are in use at present for mass vaccination.

PREVENTION

The protection of communities involves consideration of the familiar aegypti borne epidemics of cities and the more obscure problem of sylvatic yellow fever After many years of experience reasonably effective methods have been developed for the control of aegypti mosquitoes but the details of the procedures vary widely according to the local conditions A aegypti is highly domestic living by preference in homes and feeding on man An adequate municipal water supply works to the great dis advantage of the mosquito since the housebolder can then do away with favorite breeding sites such as the many jars and vessels used for storing potable water In times of necessity the mosquito shows much ingenuity in finding water for depositing her eggs such as the small amounts that collect in a flower pot or air plant or a discarded can. The development from ovum to imago requires about two weeks and many larvae and pupae might die in case a small residue of water evaporated within a few days The mosquito quite carefully as a rule lays her eggs not on the water but just above the water line the eggs withstand drying and adhere to the container Some days or weeks later when the containers are filled by a shower larvae appear within a few minutes insured of a more liberal supply of water for their development. About 2 weeks after a drought has been broken it is a common experience that mosquitoes may appear in and around homes in annoying abundance

During inter epidemic periods the imagos may be ignored and the mosquito population in cities can be reduced to a minimum by thorough destruction of larvae and pupae at weekly intervals. Small vessels of

nity Ho vever Gordon (1940) again cites Findlay as questioning the immunizing, effect of the virulent neurotropic strain, although he accepts readily the effectiveness of this strain when its activity is impaired by using liberal amounts of specific immune serum and unhesitatingly recommends a cultural neurotropic strain of feeble virulence (17 D) as providing an effective vicence.

Much attention has been given to vaccination with neurotropic strains of rather slight virulence maintained by culture in pileo or surviv ing tissue and by infection of chick embryos Findlay and MacCallum (1937) vaccinated 62 persons with a cultural 'pan tropic 'strain without immune serum. The description of this strain indicates that it is a neurotropic modification A few months later Theiler and Smith (1937) reported quite independently, the experimental immunization of 8 persons with neurotropic cultural virus (17 D) but without the use of immune Subsequently Smath et al of the Rockefeller Foundation adopted mass vaccnatuon in 1938 as a means of controlling yellow fever. They discontinued the use of immune serum and prepared a vaccine from chick embryos infected with cultural neurotropic virus. This strain upon inoculation in man induced the formation of antibodies but frequently the titer of the serum was low and a fall in titer was noted in many cases within 6 to 10 weeks after vaccination The Cooperative Yellow Fever Service of Brazil reported the vaccination of more than 59 000 per ons with the probability that under field conditions approximately os per cent of these were immunized One instance was noted in which enceph alitis occurred as a complication followed by complete recovery (Soper and Smith 1938) The use of vaccine was extended rapidly and 105 000 persons were moculated in the state of Psperito Santo in Brazil (Soper et al 1040) Some unfavorable results appeared Among 156 000 vac cinated persons 56 cases of yellow fever were reported with 14 fatalities Unquestionably these infections were acquired naturally and were in no unquestionamy tiese interactions were acquired naturally and were in no sense attributable to the injection of trues without minutes serum Protection tests in some groups indicated that 50 per cent to 80 per cent rerrained susceptible after vaccination Cultural strains of jellow fever do not remain fixed in their pathogenicity and in their immunizing properties

Choice of Virus —Successful vaccination against yellow fever depends on the injection of living virus with the development of an infection. The modified virus suitable for inoculation in man is neutrotropic in character and fortunately two strains are available. The one propagated in more is virulent and produces an enduring immunity with the risk of a small proportion of serious reactions. The cultural strain is of low pathogeneity and uncertain in its immunity effects with the risk that individuals supposedly protected by vaccination may contract vellow individuals supposedly protected by vaccination may contract vellow individuals supposedly protected by vaccination may contract vellow individuals supposedly protected by vaccination with virus from infected mice quickly obtained by mass vaccination with virus from infected mice quickly obtained by mass vaccination with virus from infected mice and propagation of the propagation

the rapidly developing albumouria the extreme prostration the usual Faget's sign a moderate degree of jaundice and somuting with or with out haemorrhage constitute a characteristic syndrome. A progressive leukopoeina occurs at the expense of the neutrophiles and reaches its lowest point near the cod of the first week of illness (Berry and Kitchen 1931). Except for those patients who show an early and extreme degree of albumnums there are no methods available either in the clinic or the laboratory for establishing even a tentative diagnosis during the first few days of illness. However this is the period of maximal infectivity of the blood and it is the appropriate time for commencing simple labora tory procedures which eventually should lead to a conclusive diagnosis preferably by the infection of sosceptible aumails or by the demonstration of neutralizing substances specife for y ellow fever

The white mouse rather than the monkey appears to be the animal of choice successful infection with vellow fever by the intracerebral injection of patient's blood having been accomplished by Mathis in 1937. In the same manner Durieux (1937) in an important communica tion reports the infection of white mice with the blood from 13 patients the virus being demonstrated in the patient's blood as late as the fifth day Death of the mice about 10 days after inoculation with char acteristic paralysis and without bacterial infection affords strong pre sumptive evidence of yellow fever confirmation of the diagnosis may be easily determined by protection tests with yellow fever immune serum If no virus is recovered from the patient's blood then protection tests may afford an exact diagnosis provided that 2 specimens of serum are examined one of which is taken during the first few days of illness and the other after an interval of 3 or 4 weeks. The first specimen shows either no protective power or else a low titer as compared with the second sample The early development of immune hodies complicates diagnosis by this immunity test. Moreover the first specimen of serum may contain neutralizing antibodies in high titer as the result of a previous infection with vellow fever the current illness heing due to some other type of acute infectious jaundice. In case of a fatal outcome the lesions of the liver are virtually pathognomonic Zenker's fluid is the fixative of choice but in circumstances where this is inconvenient formalin serves as a useful substitute

Differential Diagnosis—Difficulties in chinical diagnosis arise in mildi infections and also in those of moderate sevently with well marked symptoms. In the early days of the infection the fever rapid pulse malase ablummourn and leucopeems resemble the symptoms at the onset of a case of influenza without respiratory signs. The mild types with no jaundice may be confused with those cases of dengue fever which show no rash or one so exasescent that it escapes detection. Quite exceptionally cases of dengue fever have been said to show slight jaundice diastermble as a tingeing of the sclerac. These observations were made before the laboratory diagnosis of yellow fever had been developed and similar methods for dengue fever have not yet been perfected. Of the

DIACNOSIS

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water containing larvae may be emptied in seasons when rainfall is abundant. In and regions sanitary inspectors discarding small quanti ties of much needed drinking water have met with serious experiences and it is sufficient to remove the larvae by straining the water through a piece of cloth Shallow wells, cisterns, tanks and similar containers may be protected more or less effectively by screening oiling, or the use of small species of fish which feed on larvae. The ingenuity of aegupti mosquitoes in finding breeding places and the difficulty in some circum stances of locating the adults requires some caution in accepting the conclusion that any given outbreak of vellow fever is occurring in the absence of aegypti mosquitos. During an epidemic of yellow fever the measures for the control of larvae should be broadened to include destruction of the adult mosquitoes Funnigation of houses where cases have occurred is time consuming but this precaution may destroy some infected mosquitoes and also build up the confidence of the people and encourage their cooperation. The individual patient should be pro tected by screening or a bed net for his own comfort throughout the course of the illness and not merely for the first few days thereby avoiding any necessity of explaining to the laity the scientific details concerning the mode of transmission Prophylaxis for the individual consisted formerly in avoiding mosquitoes but vaccination now constitutes the method of choice allowing a period of a few weeks after inoculation to elapse before exposure to yellow fever In case of exceptional emergency immediate but temporary protection can be secured by passive immuniza tion with liberal amounts of a potent immune serum. For the purpose of quarantine a period of isolation for 6 days has been adopted and this has proved reasonable in practice and preferable to more stringent measures of endeavoring to cover the exceptional maximum limits of incubation. The replacement of sailing vessels by steamships virtually climinated the transfer of vellow fever to and fro across the Atlantic Ocean The development of air services offers new problems of interest to the epidemiologist but the aviation officials cooperate willingly and effectively with the health authorities Our southern border hes but to or 12 hours distant by aeroplane from potential foci of vellow fever on South America. In British India all air traffic from the west arrives at Karachi and the airport there has been made anti amaryl the Government taking every precaution to prevent the introduction of the wrus either in patients or infected mosquitoes (Russell 1939)

The lack of detailed information concerning the hosts and vectors of substate yellow fever precludes the adoption of any effective measures for controlling this infection in the wild hie of the forests. For man vaccination constitutes the only practical measure for protection

DIAGNOSIS

As indicated by the symptomatology the climical diagnosis of severe cases during an epidemic is relatively simple and accurate. The features are not pathognomonic but he acute onset with headache and backache

serious symptoms develop. The gradual loss of fluids and the umbalance of inorganic salts as indicated by studies of urine suggest the use of some form of Ringers solution. The impairment of renal function with suppression of urine is more serious than one would expect from the lesions seen in the hidney. In terminal stages an accumulation of undetermined acids results in a reduction of securi bearbonate (Wakeman and Mortell (1923). Sternberg (1869a) recommended Vichy or slakaline mineral waters or the administration of small dady amounts of sodium bear bonate, such as 1 g grams to hiberal amounts of drinking water. The disturbing gastro intestinal symptoms may be controlled more or less effectively by the use of atropace.

Special Measures -In the acute stage of yellow fever the custom prevails of prescribing an almost starvation diet supplemented by citrus ruces when the patient is able to retain them. In contrast to this practice the injury to the liver with impairment of glycogenic function and the frequency of hypoglycaemia requires the liberal use of glucose espe cially by intravenous injection. The administration may be guided by sugar determinations in case the facilities of a chemical laboratory are available. Remarkable results are not to be expected but this treatment adds to the comfort of the patient and constitutes a rational supportive measure. The possibility of guanidine intoxication must be kept in mind. The metabolism of guanidine substances following insury of the liver has been investigated extensively (Lamson Minot and Robbins 1928 Minot and Cutler 1928-1929 Minot 1919) The administration of calcium relieves guanidine intorication in a striking manner not by destroying guanidine but by neutralizing its toric effects. Calcium lattate in doses of a grams daily is suitable for oral administration, and calcium gluconate in 7 5 per cent solution may be given in 10 cc amounts by intramuscular but not by intravenous injection. In principle fluids should be supplied liberally, the carbohydrate reserve should be protected alkalies are to be used in small amounts with discretion and the adminis

alkalies are to be used in small amounts with discretion and the administration of calcium should prevent any symptoms of guanidine intorication.

Specific therapy is not available at present. Immine serum of high litter even in large amounts is inclinated using the fever has developed.

and it is better not to disturb the patient by such injections (For addendum 1942 see p 904)

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severe and even fatal types of acute infectious jaundice much confusion has arisen hetween yellow lever and lephospiral jaundice (Weil's disease) and this confusion persisted for some years after the introduction of reliable laboratory methods for the recognition of lephospiral infection. Briefly, the guinea pig is the animal of choice to inoculation with infective blood or urine of patients or for a protection test using virulent leptospiral and convalescent serium. The severity of leptospiral infection varies through all gradations from a febrile reaction lasting for a day or two without jaundice to a mortality of as much as one bind of the cases. In its severe form the jaundice may be more intense than in vellow fever but the albuminum is less marked. There are several other minor distinctions but the final conclusion rests upon the laboratory findings. Cases of relapsing fever and maloria fever may occasionally show some jaundice. In regions where malarial infection is prevalent it is customary to emphasize the precaution that the finding of malarial parasites does not excited infection with yellow fever.

T ROCNOSTS

The condition of patients whose progress appears to be atisfactory may without warning become altogether critical and this insidious nature of the infection requires especial caution in predicting the course of the disease After long experience Dr E J Scannell suggests that a good prognosis may be offered with certainty only when the patient is out of bed and dressed and out of the house and walking down the street There are many features of unfavorable portent notably haematemesis melena extreme malar e suppression of unine and peptonuma (1708) listed 21 unfavorable signs among them a preternatural appetite more especially in the last stage of the sever and this observation becomes of ignificance in view of the low values for blood sugar following mury to the liver In summarizing the temperature records of 260 patients Sternberg (1890) noted that 22 with a temperature of 106° or higher ended fatally and 44 cases whose temperature did not exceed 103° had the good fortune to recover the mortality for the group being 7 5 per The mildness of the disease in children has been somewhat over emphasized Some fatal infections occurred in infants during the out break of 1927 in Parahyba Brazil Hanson (19 9) in a severe epidemic in Peru noted a mortality of 83 per cent in children of z to 3 years of age and 34 per cent in a group from 6 to 10 years old

THERAPY

General Measures—Rest m bed is altogether essential even in supposedly mild infections. It is much better that a patient taken ill in unfavorable surroundings should be made reasonably comfortable rather than to take the very real risk of transportation to a more suitable environment. A purgative is appropriate to relieve constitution at the onset of the disease with preference given to enemata when the more Peluer M Duneux C Jonch re H & Arqueé E Vaccination mi te contre la fibre jaune et la variole sur des populations indigenes du Sénégal Bull Acad 123 137 1940

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the rapid and accurate diagnosis of yellow fever in which the isolation of the virus by inoculation into susceptible animals and the bistological investigations from liver sections from fatal cases and mouse protection tests on the blood are made

With reference to the Nuba Mountain epidemic the attempt to isolate the virus was not commenced until the epidemic was dying out rapidly so that difficulty was experienced in finding patients in the early stages of the disease

However (Mahaffy Hughes Smithburn and Kirk) were able to isolate from patients who had exprenenced a mild attack of the disease two strains of virus and the results of stude of the reactions in animal their juminoslogical properties and the lesions induced by them permitted a conclusive identification of them as strains of yellow fever virus. While yellow fever virus and previously been solated in West Africa it had not been in Central or East Africa a lithough the ensistence of the doesn't had been indicated pre-tously been solated in West africa it had been indicated pre-tously by the results of innovinty surveys:

The League of Nations report that in the Nuba Mountains A edges oxyyfn is prevalent in small numbers during the rainy season but its comparative absence in most parts of the year has led to the suspicion that this outbreak may have been due to the jungle type of the disease. Other species of A of A and A forms A f conso which are known to be efficient transmitters were collected in A regard at the accordiones of the Sudan to

In regard to the yellow fever situation in the Americas Sawyer (1942) emphasizes that the outstanding characteristics of the historic yellow fever picture were sudden epidemic extensions of the disease far beyond known endemic foci followed by the absence of the disease or relative quiescence. In his discussion of the outstanding features of the yellow fever situation in the Americas at the present time he points out.

(i) Absence of definite enthreaks of whose segipts transmitted yellow fiver any where (i) Absence of recogn early place fiver of any transmittent type outside of South America. (j) Jungle yellow fever a series and as megating updem ca in wide areas of the untern of South themics. (d) Effect e-methods for keeping self is non infectible through Ads segyptic control and (j) A safe and effective way to immun as against yellow fever and no yeart its spread from the jumple to infectible cities.

A report from the Brasilan Federal Public Health Service of 1948 has posited out that the 7 nyllow feer of asppeared from the country and has not been present since 1944. In regard to the stuation concerning jumple yellow fever whereas 117 cases of their detactive of accesserating 1954 and 1954 and

With reference to prevention Sawyer points out the importance of control work carried out in American cities and that such control by keeping the city of Rio de Janeero non infectible possibly prevented a senous epidemic of yellow fever in 1938 following the entrance into that city of four persons infected in the unified areas

Soper (194) under whose direction the control methods have been prosecuted points out that these include the weekly investigation of premises for Λ expyft larva the destruction of breeding places and the search for additional mosquitoes by special squads with finding and destruction of breeding foci if mosquitoes are found the application of petroleum (3 parts fuel of and 1 of kerosene) is recommended as being more effective than inertly emptying out the water. Breeding has been so greatly reduced by such methods that it man, cutes it has been possible.

Soper F L Jungle yellow fever A new epidemiological entity in South America Rev Hyr e Saude Publica 10 107 1936 Cated by Trop Dis Bull 34, 344

1037 Soper F L Penna H Cardoso E Serasim J Jr Frobisher M Jr & Pinheiro J Yellow fever without Adder accepts Study of a rural condemic in the Valle do

Chanaan, Espirito Santo Brazil 1932 Amer Il flyr 18 55 1933 Soper F I Rickard F R & Crawford I J Routine po t mortem removal of liver tissue from rapidly fatal fever cases for the discovery of silent yellow fever foci

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by mause protection to t and epidemiological observations 3rd Internst Congress for Microbiol N N Sept >-0,133 Report of Proc P 351 N Y 1940 Stefanopoulo G & Wassermann R Sensibilité du cobaye au wurs neurotrope de la

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Addendum -- Since the preparation of this chapter upon yellow fever Findlay has reported upon the distribution of the disease in Africa and ha published two maps showing the changes that have occurred In one of these is indicated areas in which actual cases of the disease have been recorded between 1921 and 1941. In the other are shown the areas in which positive results have been obtained with immunity tests to yellow fever. The areas in the latter map are much more numerous and more widely spread More recently (toward the end of 1940) the most extensive epidemic of yellow fever recorded in Africa has occurred in the Nuba Mountain region of the Anglo Egyptian Sudan in which over 15 000 cases with 1 600 deaths were reported. There is evidence that the infection may have been present in the Sudan for a long time since mouse protection tests have given positive results in every region where they have been employed

Findlay Kirk and Let is (1941) have emphasized the diff cility in diagnosing vellow fever in the field by chinical means and that this has been well illustrated by the occur rence of two epidemics not of sellow fever but a sociated with jaund ce and black vomiting which occurred during 1940 in the Tagon h Ils and in and around El Obeid At the same time yellow fer er was present in other parts of the province of Kordolan (Fast Sunad) and he points out it is suggestive that laboratory proceedures are essential for The outhreak which has occurred in our troops especially between March 7th and July 4th 1047 following the use of vaccine against 5ellow fever was reported by Secretary of War Henry L. Stimpson on July 24th when it was announced that 28 585 cases of jaundete had developed among the Army. Personnel and of those effected 24 057 were among troops in the United States and 4 528 among personnel abroad. The ratio of deaths was 1 for every 45c cases or a total of 6 deaths in all

Circular letter humber og from the Surgeon General s Office United States Army mas published in the Journal of the American Medical Association September 5 1042 which pointed out that the peak of the incidence among the troops in the United States was reached in the week ending June soit since when there has been a progressive and un inter rupted decline. In this Circular there are reported epidemiological clinical and pathological conditions regarding the outbreak. The epidemiological features have especially been studied and emphasized by Colonel S Bavre Jones. The pathological material has been assembled at the Army Medical Vuseum Washington D C and has been particularly studied by Lt. Colonel Baddwin Lucke

The third pathological leasons observed were those of acute or sub acute y allow or red atrophy of the layer. The earliest leasons consist of frash nections of liver cells in the central parts of that lobules. There are no inclusion bodies present at any stage. The leasons differ distinctly from the leasons of yellow fever. The Surgeon General is the in the appray ordered discontinuation of vaccine then in use and since then the vaccine has been prepared without the human serum comp next and it is hoped the risk of

saundice has been elimi ated

Regulations concerning vaccination against jellow fever a e-matters of international importance. Those in effect for the United States Army are coordinated with British regulations applicable to areas in which jellow fever is endem or a potential hazard All military personnel of the United States Army traveling to or through or stationed in areas in which yellow fever is endemic abould be vaccinated against the disease. At the present in the these endemic areas are defined as follows. In the Eastern Hermi States are successful as follows in the Eastern Hermi States and the Company of the Company of

The yellow fever vaccine used in the military service consists of a special strain of living yellow fever virus which has been attenuated through cultivation in chick embryos. The mate all is placed in ampules and is then any dly frozen desicated.

sealed and stored at a temperature not higher than o C

rated vace ne O yo ed so ss required Every p ecal ton must be laken to avoid give g like vaccine of 1 fed

(a) After an ampule of vaccine has been opened any vaccine which remains unused after 1 hour will be discarded

after a hour will be discarded

(3) Yellow fever vaccine will be admin steed only to persons who are in good health and who are feee from acute disease

React one from I ellow Fener I access—Abo t 5 pe cent of those receiving this vac-

Sellards (1941) emphasizes that effective immunization requires the injection of living modified virus and the development of an infection in view of the severe reactions which sometimes follow the use of living

to lower the cost of the service by lengthening the period between house inspections

Soper also emphasures the success that has been achieved in certain tomonan South America in which there has been complete eradication of the species Adea argylis. For example in at least tax states in Brand it can no longer be found and the same is time in certain areas in Bolyus. The ancess achieved in some of these campaigns he points out gave confidence and inspiration to the workers in the conquest of A gambies from other areas in Brand.

Sawyer however points out that while cities may be kept free of infection by Aeder
aegypii control vaccination is the only measure practicable against jungle yellow fever
and that to date it has been applied on a large scale mostly to stop an existing epidemic
or to immunize against an expected one

Bauer (1930) calls attention to the fact that during the application of the earlier type of vaccine especially when a tissue culture virus grown in the presence of mouse embryo tissues (Lloyd Theiler and Ricct) and summine serum of either human or animal origim was used, delayed jaundice was observed among certain of those vaccinated Attention is called by Sellards (on page 895 of this chapter) to the development of jaundice of unknown etiology in 20-30% of those vaccinated (Soper and Smith 1938) Findiay and MacCallum had a similar expension in England in which jaundice or hepatitis developed and are inclined to believe that the jaundice was due to a cuitaminating virus present in the vaccine possibly cultivated along with the virus of yellow fever in the tissue culture which had a long incubation period and a selective affinity for the liner. However following the introduction of another strain of virus in Brasil no jaundice apparently occurred in the inoculated until 1030.

In about 50 per cent of the individuals vaccinated with 17D virus traces of it were found in the circulating blood after vaccination. Hoaver it was definitely proved through a sense of experiments by Whitman that thus concentration is anadequate for infecting mongulates. and on the basis of the results of these and other experiment on both man and monkeys. Bauer feels consider that there is no danger that vaccinated persons serve as a butter of infection for monquities.

For Penna and Para (1042) have made a careful study and give a detailed account of the interess and hepatitis in Brazil following vaccination against yellow fever in 1939 and again in 1940. In the 1939 outbreak nearly 27% of the 304 persons viacinated with the 17D virus became interior for the most part during the 4th or 5th month following vaccination. In the 1940 outbreak there were 1 072 cases and 24 fatalities. From their clinical and pathological findings, which are discussed in detail, there was revealed that the disease process fundamentally involved injury to the hepatic parenchyma and there were produced in fatal cases, liver lessons similar to those een in acute and sub acute yellow atrophy.

Although the duesse is chincilly indistinguishable from the group of cases classified as earthal justicies or infectious or epidemic hepathis it differs from this latter group in its unusually long incubation period and in its predilection for adults. Whether the agent giving rise to the paintine was a contaminating view which gained entrance to the vaccine view classified by way of human action and presisted through an indictine series of tissue culture passages as a strain contaminant could not be concluded.

Chapter XXIV

DENGUE AND DENGUE-LIKE FEVERS

DEFINITION AND SYNONYMS

Synonyms —Dandy fever (the word dengue is supposed to be derived from the Spanish equivalent of dandy or denguero) break bone fever bouquet. German dengue fieber

Definition —Dengue is an acute infectious disease due to a filterable

virus transmitted by species of mosquitoes of he genus 4edes

It is characterized by an initial three or four day febrile paronysm of very sudden onset a remission which comes on about the fourth day and a terminal rise of temperature for two or three days—the saddle back temperature convers. Backnote and pains about the miscular attachments at the joints and especially a marked postorbital soreness are important features. An emption appears about the third of fourth day. Leuko penna and polymorphonuclear reduction are constantly noted. Apathy and a midd neurastheme state may continue into convolescence.

The striking eruption which appears about the time of the remission of the fever has caused the term bouquet to be applied to it while the severe pains in the back tooms and posterior orbital muscles suggest the

name of break hone fever

HISTORY AND GEOGRAPHICAL DISTRIBUTION

History—While Hirsch gives the credit for the first mention of the disease to the chronicer Gaberti who described a disease with certain resemblances to dengue as ensing in Cairo in 1779 yet for the reason that certain clinical features of this epidemic would hardly appear to belong to dengue as we know it there would seem to be good ground upon which to give the credit of priority to Benjaman Rush who under the designation break bone fever gave us a true picture of dengue as it main fested itself in Philadelibhia in 1780.

Gaberti was particularly impressed with the knee involvement so that from his description the disease was known as the disease of the knees He lurther noted swelling of the fingers and that the pains continued for more than a month. The sudden onset and the sweating would seem to belong to relapsing fever as well as to dengue and in support of the view that the disease described by Gaberti might have been relapsing fever we have the statement of Sandwith that bone pain chiefly of the knee is the symptom most complained of by the Egyptian native with relapsing fever.

neurotropic virus from mice, he made experiments, using very dilute suspension of the French neurotropic strain injected intracerebrally into monkeys

When the dilution reached 1 5 000 000 or 1 10 000 000 the inoculation of 0 1 c c or less into the cisterna magna of monkeys produced no clinical symptoms but four out of five were immunized.

The morulation of similar doses intracerebrally was usually followed by death from cacephalitis. Out of two mankeys with gross trausing and the frontal lobe invariated substudanceusly with larger doses one died of yellow fever and the other remained well and developed immunity. He points out that accidents of vaccination have occurred in any form of technique in which husing virus is employed and up to the present patients have shown symptoms of memingitis encephalitis or myclitis followed by complete recovery without sequelae.

He believes that sero vaccination has limited possibilities for on some occasions many of the patients failed to develop a protective serum and a few of these persons subsequently developed yellow fever, some of the infections being fatal. He considers that there is opportunity for improve ment in any of the techniques in use at present and quite clearly they do not represent in detail the methods which will eventually be developed for vaccination against yellow fever. The said alliess which recently terminated in death prevented Doctor. Sellards from further investigations upon this disease.

torus upon this several experience to the therapy of yellow fever states that the situation can be given in the words of Lins: the disease cures itself or kills in spite of anyand every treatment. Once yellow fever has declared itself there are no known specific serological or chemical agents of value sithough there are certain clear indications for symptomatic treatment and careful nursing is essential. (R.P.S.)

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November 1941

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906 ETIOLOGY

Beylon who reported an outbreak of an epidemic disease in Batavia in 1780 stated that everybody was attacked and that the symptoms were almost the same as those ushering in plague-readache fassitude and pains in the joints. He noted however that this epidemic had no had consequences patients getting rid of it in three days under moderate diet and copious beverages Ashburn and Craig in 1007 proved that the disea e could be transmitted by injections of blood filtered as well as unfiltered. Ban croft (1906) and Cleland and his associates (1916) demonstrated the direct e is transmitted by the mosquito Aeder accepts

Geographical Distribution - Dengue fever may occur in epidemic form in almost any part of the tropical or subtropical world. It is very common in the countries about the China Sea the Pacific Islands and in the West Indies In South America it has been reported as far south as Sao Paulo Brazil In Australia in 1921 almost half of the nonulation of Brisbane suffered from it the infections occurring rapidly in the course of a fe v veeks. It is still very prevalent in North Australia and occurs along the northern and eastern scaboards especially in the northern territory along the central Queensl nd coast and the Northern Rivers district of New South Wales In 1928 very large eq 1 demics occurred in Greece and Egypt which a tracted great attention among medical men in different parts of the vorld. In the years 1917-28 a million and a half people were said to have been attacked. In Carro in 1937 Wakit reported an epidemic of 2301

In the United States since 1821 when the disea e appeared in Charleston S. C. epidemics have occurred from time to time which have been usual a hmited to the Gulf states though ometimes the disease has occurred as far north as Philadelphia New York and Boston During the summer of 1883 three quarters of the population of western Texas were reported as suffering from dengue and in 180 ball of the inhabitants of Dallas In 1922 and arain in 2014 epidemics occurred in the southern states when in 1922 more than a million cases vere reported

In earlier years several emdemics of the disease occurred in Honolulu notably in rook when some so oon cases a ere reported. A smaller outbreek occurred in 1012 In 943 a net outbreak started in July in Warkiks. By September the epidemic reached its peak with 160 new cases per week. The total number of cases up to the

end of December 1943 had reached 1 340 as reported by Usinger

Sapero (personal communication 1944) reports that dengue has appeared in epi demic proportions in many of the Pacific island during the present World War. These epidemics have com i led ; ith the distribution of tedes argupte. The disease spread to newly occupied islands from such old endemic loci as Tulan. New Caledonia and I'm The sortead through the Pacific islands began at Tulage and continued easty and to the Hawa ian Islands i here for the first time m some years dengue appeared in epidemic proportions in Honolu a . All occupied islands were not involved. Only those islands became affected in a high Acdes gestale existed before occupation and in a high con ditions became favorable for their increased density

Carson (1944) emphasizes that the disease has become an important can e of absence from duty in the South Pacific combat area. The infection has been introduced into islands where it was not present by aviation personnel coming from infected regions The suggestion is made that pos ibly Aeder variegati s var Jebridens might be a sector although positive proof is lacking This mo qu to las eggs in holes anywhere along the trunks of tree and the beavy ramfall provides sufficient moisture for larval development. At least to weeks absent of om trenous duty was usual in the average case

McCarthy and Brent (1943) have given an account of an outbreak in Europeans and Africants occurring in the Comoro Islands east of Tropical Fast Mrica The outbreaks followed a rapid increase in Aedes mosquitoes

PRIOLOGY AND EPIDEMIOLOGY

Etiology -The disea cas caused by a filtrable virus which is present in the patient s blood from the onset to the third day No vis ble organism is recognized as the cause of the d sease Graham reported a peroplasm like organ am as the cause but ther workers have failed to confirm this Couvey reported the presence of short or to chartes in the blood 2 or 3 hours before the onset of the f er never later They had

2 or 3 turns and fine extremates Several other reports of the presence of sputochaetes in the blood have been made However it is not recognized that the disease occurs entirely, independently of any visible microorgan sm. Cleland and many others have a collect guinea pigs and rabh its without result and have been unable to find sputochaetes.

Ashburn and C a g (1907) demonstrated that a filtrable virus 1 pre ent in the penpheral blood of pat eats from the day before the initial feer until the third or fourth day of the die a c They found that the filtrate was infictive when in culated either intravenously or subcutance usly into su ceptible individuals

The culty at on of the virus of sandfly fever and of dengue fever in the chorio allantoic memb a e of the chick embryn has been recently seported in India by Shortt (See sa d fly fe er p 948)

Virus containing serum remains infecting for or a months if kept in scaled tube

Virus contains g serum remains infects is for or 3 months if kept in scaled tube and in the dark. The rem is destrowed by a temperature of 90. for 30 minutes. If wever the can be clined on the dark of the contained to the contained of the conta

Transmission -Graham in Syria suggested that the disease is trans mitted by a mosquito Culer falseans but no satisfactory experiments were published. In 1997 Ashburn and Craig showed that this mosquito may sometimes transmit the disease mechanically. In 1906 Bancroft in Australia transmitted the infection through Aedes gegypts and in a senes of carefully carried out experiments Cleland Bradley and McDonald in Australia (1016) and Siler Hall and Hitchens (1026) in the Philippines demonstrated conclusively that the disease is conveyed by Aedes aegypti (see Fig 200) and not by Culer fatigans It was shown that the blood of a patient with dengue fever can infect a mosquito during the last day of the incubation period and several hours before the onset of the fever and that the blood remains infective during the first 3 days of the disease After ingesting infected blood from 8 to 11 days (depending on the temperature) must elapse before the mosquito can transmit the infection to man thus paralleling in a way the transmission of yellow fever. The mosquito after it is infected remains so throughout its life. In one instance it is reported a mosquito transmitted dengue that was infected 75 days previously No evidence has been produced demonstrating that the virus is hereditarily transmitted in the mosquito temperature is below r8 C mosquitoes do not become infected

Šimmons and his coworkers (1931) in Manila showed that the dengue virus as it exists in the mosquito Medes eepybr is filtrable. They were unable however to infect larvae by adding the virus to the water in which they were reared. Apparently the virus is distributed throughout the tissues of the mosquito.

Kokzumi (1917) reported 2 positive cases in which the transmitting insect was Actes albopicius (Stegomya scuttllaris) and another common oriental house mosquito (Despoydea obturbans) Simmons (1940) states there was some question in these cases as to whether the precautions

taken had eliminated the possibility of natural infection with 4edes aser bis However, 4 albopictus was reported by Morishita (19 5) to transmit the disease in Formosa and Simmons (1030) found it to be an effective vector in the Philippines Also in Sumatra Schuffper and Snijders (1031) bave demonstrated this fact However, Mertens, found that in Java A degy pli is a better carrier of the disease than Aedes albopic ius In Florida, it has been suggested on epidemiological grounds that Aedes Igensorhunchus may act as a transmitter *

Many attempts bave been made to produce infection with the virus ot dengue in laboratory animals. These bave in almost all instances failed However Simmons (1931) found that it was possible to infect certain monkeys Macocus philippensis, caught at elevations above 4000 ft in the dengue free mountains of Luzon and monkeys M fuscatus imported from Japan The disease was transmitted by Aedes mosquitoes from infected human volunteers to the monkeys and from these animals it was transmitted through mosquitoes to other monkeys, and back to man However the symptoms produced in the monkeys were not sufficiently characteristic for diagnosis Blanc (19 9) also has reported the production of symptomiess infections in Asiatic and African monkeys by blood proculations

Epidemiology -Only dengue and influenza seem to afflict communities with such dramatic suddenness and extent. In the history of dengue there are similar pandemic recurrences as in influenza. It is not infrequent for more than half the population of a city rapidly to become victims of this temporarily most incapacitating but least fatal of the epidemic diseases. It is now believed that dengue is not transmitted in nature by Culex fangans, the common culicine species of the tropics but by Aedes derybis the transmitting agent of yellow fever. However, as noted. Summons (1940) and others have shown that Aedes albebicius is a biological vector. Also, in some experiments in which large numbers of Culex fair, ans were employed at appeared that mechanical transmission of the virus might occur

Addes mosquitoes are often termed the domesticated ones since they are observed to breed and pass their lives in the immediate environ ment of man and further to be distinctly urban rather than rural, in their distribution. For their breeding places they choose artificial collections of water such as cisterns, barrels pails, bottles and cans in or near dwellings. These mosquitoes are small in size silver striped vicious feeders, and very alert The female alone bites blood apparently being necessary for ovulation. It feeds especially during the morning and afternoon hours -much less commonly at night unless there is a light Other points regarding this mo quito have been discussed more fully under vellow fever, Chap XXIII

The enidemiology of dengue fever appears to be especially dependent upon the conditions which are favorable to the development of the mos quito, itdes aegyph In its pandemie form it not only occurs in coastal towns but may ascend mountains to an altitude of 5000 ft When it

Recent work tried out in the Southwest Pacife by David Atherton and others I as demonstrated that 1 ides sculellarss as capable of transmitting the disease in experiments

in human beings

extends beyond ordinary tropical limits the extension occurs only during the summer months or hottest part of the Jear sometimes in the early autumn In the Far East the disease occurs particularly after the rainy season June July and August It is usually more prevalent in coastal towns and about the deltas of great neers

Blanc (1932) notes that for an epidemic to occur the locality should have here free from outbreaks for a considerable period and that *ledes* mosquitoes should abound *A less dramatic outbreat is followed by the explosive one the virus being maintained in the interval chiefly in the mosquito At the time of its most active hreeding the widespread epidemic appears

PATHOLOGY

As death occurs very seldom in the uncomplicated disease reports of autopiese upon dengue fever patients have been few Maison Bahr (1590) notes that in the autopiese reported localized pulmonary and intracranial inflammation were the special features. Serous effusions in the neighborhood of joints have also been noted. Myocarditis and neighintic lessons and a true encephalist have also been mentioned Meekins (1795) observed cloudy swelling of the viscera particularly of the liver which might be fairly and a few pretential haemorrhages in the gastro intestinal tract. Heiser (1037) mentions one autopsy in an uncomplicated case in which the only almormative noted was an enlarge ment of the internal lymph nodes. There was no increase in the size of the liver or spiece.

A number of deaths were reported during the Greeian epidemic but these occurred only among the very aged and hence the lesions reported have little significance. It seems obvious that we have no definite knowledge of any characteristic pathological changes in the disease

Immunity—The question of immunity in dengue fever is not entirely clear. One attack frequently appears to protect. However de Langen (1936) points out that it is certainly not everptional to find a person having had more than one attack in an epidemic and Manson Bahr (1930) states second and even third attacks have been recorded. Nevertheless a number of workers have fasted to reproduce the disease by injecting virus into individuals within 1 to 10 months after they have recovered from an experimental infection. Thus Schule found that certain of his volunteer American soldiers proved remarkably resistant to experimental infection with dengue blood. They had for some time been resident in an epidemic area of the disease and it was suggested that this immunity might be due to previous mid attacks of the fever.

Manson Bahr (1940) says that memutty in dengue does not last more than six months

However Simmons (1931) demonstrated from experiments on about 100 soldiers that a protective immunity after incoulation could last at least 12 months

Simmons has found an immunity among natives and monkeys in endemic areas He suggests that a virus reservoir might be maintained

taken had eliminated the possibility of natural infection with Aeies aegyph. However, A allopichus was reported by Morishita (1925) to transmit the disease in Formosa, and Simmons (1920) found it to be neffective vector in the Phihippines. Also in Sumatra Schuffiner and Snujders (1931) have demonstrated this fact. However, Mertens found that in Java A cepypt is a better carrier of the disease than Aeles allopic ins. In Florida it has been suggested on epidemiological grounds that Aeles facinity mentions with a care at an armsmitter.

Many attempts have been made to produce infection with the virus of dengue in laboratory animals. The e have in almost all instances failed. However Simmons (1931) found that it was possible to infect certain monkeys, Meacus; philippensis, caught at elevations above 4000 ft in the dengue free mountains of Luxon, and monkeys M fuscous imported from Japan. The disease was transmitted by Aeder mosquitoes from infected human volunteers to the monkeys and from these animals it was transmitted through mosquitoes to other monkeys and back to man. However the symptoms produced in the monkeys were not sufficiently characteristic for diagnosis. Blanc (1920) also has reported the production of symptomless infections in Asiatic and African monkeys by blood inoculations.

Epidemiology—Only dengue and influents seem to afflict communities with such dramatic suddenness and extent. In the history of dengue there are similar pandenue recurrences as in influenza. It is not infrequent for more than half the population of a city rapidly to become victims of this temporarily most incapricating but least fatal of the epidemic diseases. It is now believed that dengue is not transmitted in nature by Culex fairgors, the common culcine species of the tropics but by Aetes acyopit, the transmitting agent of yellow fever. However as noted Simmons (1940) and others have shown that Aetes albegicative is a biological vector. Also in some experiments in which large numbers of Culex fairgorn were employed it appeared that mechanical transmission of the virus much occur.

Adder mosquitoes are often termed the domesticated ones since they are observed to breed and pass their tives in the immediate environment of man and further to be distinctly urban rather than rural, in their distribution. For their breeding places they choose artificial collections of water such as externs barries paid, buttles and cans, in or near dwellings. These mo quitoes are small in size silver striped viscous feeders and very alter. The feemale alone buttes blood apprently being necessary for ovulation. It feeds especially during the morning and afternoon hours—much less commonly, at might unless there is a light Other points regarding this mosquito have been discussed more fully under yellow fever Chap. XXIII.

The epidemiology of dengue fever appears to be especially dependent upon the conditions which are favorable to the development of the mos quito, Albie eegphi. In its pandemic form it nit only occurs in coastal towns but may ascend mountains to an allitude of 5000 ft. When it Recent work introd out in the Southeut English Drivid Albierton and others has

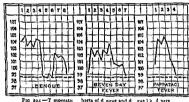
demonstrated that Aedes scufellaris is capable of transmitting the di ease in experiments

in human being

ment of the tornts and the so called joint pains are really pains of the muscular insertions about the joints. The backache of dengue is usually a well marked feature. I am on motion of the eyeballs is a prominent symptom-it is a deep soreness

Insomnia characterized by frequent dropping off to sleep to be awak ened immediately by disturbing dreams is often noted. The depression mental and physical is altogether out of proportion to the lack of serious ness of the disease Malaise and anoregia are marked Constitution is the rule at first

About the third or fourth day the temperature drops to normal or about that and remains so lowered for from 12 hours to 3 days this time the patient feels much better and views his affection in a less serious light. After this variable intermission, the temperature rises to



harts of d ngue and d gue lk (vers

possibly a greater height than primarily although as a rule it is less marked This interval or intermission separating two periods of fever gives a temperature chart designated as saddle back. However there may be only one rise of fever This second febrile attack is attended with pains and possibly greater depression than the first accession. It is usually however of shorter duration and during this period the terminal rash appears This is the most characteristic feature of the disease. It generally manifests itself about the dorsal surface of hands and feet advancing up the forearms and legs Later on it may involve all the extremities face and trunk. The eruption is much like that of measles but lacks the dusky red appearance of the measles rash. It may how ever be punctiform and thus resemble the rash of scarlet fever

With the appearance of the terminal rash crises may occur such as profuse sweating or marked diarrhoea or epistaxis The de quamation is furfuraceous in character and may be attended by marked itching. In some patients (Caucasian) there is a rosy carmine flush of the palms of the hands and soles of the feet Some authorities have reported glandular enlargements in dengue

in an endemic area in the absence of susceptible human beings as has been later suggested to be the case with jungle vellow fever

Specific antibodies undoubtedly are produced in dengue lever, as the worf of Shortt (1938) in India would indicate Manoussakis (1938) however observed that convalescent serum collected during the first month after recovery and inoculated into volunteers before and after the injection of virus failed to protect against infection. Other observers have obtained negative results in the few attempts which have been made to treat dengue fever with such sera. Relationship to Yellow Fewer—There are certain resemblances.

between dengue and yellow fever especially the manner of transmission and that each is due to a filterable virus, also the length of the incubation period and the type of fever are similar. Here the resemblance appears to end as the virulence of the infective viruses is entirely different and the immunity to yellow fever is persistent for long periods. Neverthe less many authors have stressed the similarity of dengue and yellow fever clinically and epidemiologically and there has arisen an idea that an attack of dengue might give a certain degree of immunity to sellow fever It is generally accepted that the immunity following vellow fever is absolute and fairly permanent while that from dengue is mo t variable and individual. It has been suggested that this may indicate there are several strains of dengue virus but only a single strain of vellow fever virus Dinger tried to infect m to with dengue virus by Theiler's intra cerebral method of moculation without effect. He subsequently mocu lated a number of the same mice with vellow fever virus and all died of encephalitis Schuffner and Smyders (1033) have successfully demon strated that the viruses of veilow fever and dengue are distinct and the protective inoculation of the virus of one does not protect against the Smiders Postmus and Schuffner (1934) used the sera of 20 vol unteers who had been experimentally inoculated with dengue virus and using both the Theiler test and Sawver's modification they were unable to demonstrate any protective influence of these sera against yellow fever virus Blanc in Greece has also found that anti yellow fever serum has no neutralizing action on dengue and Stefanopaulo also showed by the mouse protection test that the serum from dengue convalescents has no influence on the yellow fever virus

SYMPTOMATOLOGY

After a period of incubation of from 4 to 15 days more generally from 5 to 0 days the disease manifests itself with striking suddenness in fact the patient care generally recell almost the hour of the onset. The temperature rapidly rises and in a few hours reaches a maximum of from 102 to 102 ft. Associated with this primary fever there is frequently a blothy congestion of the face—the so called initial rash

There is usually intense headache principally supraorbital and post orbital. The pulse rate is slightly accelerated at first, but soon becomes slow and may fall to 50 from the fourth to fifth day. There is no involve

r

(i) The pulse rate is slow for the temperature rise thus reproducing a phenomenon common in yellow fever (Fagets sign). It is in recent epidemics particularly that chinical descriptions have recorded the fre quency of a very slow pulse most of the older authorities having noted a pulse rate which corresponded to the electation of temperature.

(2) In some epidemics the feature of glandular swelling is prominent

while in others the swelling is so slight as to be overlooked

(3) The characteristic saddle hack temperature chart seems lacking in the majority of the cases in certain outbreaks. It is possible that some justice pidemics showing atypical temperature curves may have been due to phlebotomus fever an allied virus or seven day fever instead of dengue. However the temperature is often variable as regards type in the same outbreak.

(4) In some epidemics the rash is insignificant or very slight in most cases. This observation is possibly dependent on the ephemeral character of the eruption in certain groups of cases.

(5) From the chart Fig 205 analyzing the symptoms in one epidemic it will be noted that Lane observed cold clammy dusky extremities in

27 per cent of his cases This is an unusual finding In the Athens epidemic gastro intestinal disturbances vomiting epigastric pain and haemorrhages into the skin and mucous membrane together with complications such as parotities oftis media and broncho pneumonia were noted De Langen (1936) has noted as complications febrile albumulura parotitis and orichitis

Symptous in Detail

Onset and the Temperature Chart —Dengue probably sets in more abrupity than any other disease
The temperature chart is often typically saddle back

The Pains —Very marked soreness is often experienced deeply seated about the place of origin of the ocular muscles so that every movement of the eveballs is at once complained of as giving pain

General pains all over the body are common more especially of the back and about the tendinous insertions of the muscles which cause the pains to be referred to the joints. The kine-point pains are probably the most frequent. The rachialgia may be as great as that in variola or yellow feer.

The Erupton —The characteristic cruption does not appear until about the time of the intermission or with the accession of the terminal fever. The fall of fever about the third or fourth day is often attended by a critical operature where the statement of the succeeded by an intermission of from it to 3 days of a feeling of well being. About this time or with the secondary rise of fever the true dengue rash appears. It is at first noted frequently about the bases of the thumbs and extending over the dorsal surfaces of the wrists. Almost simultaneously a meaales like rash appears over the dorsal and internal surfaces of the big toe extending to the ankle especially over the internal malelous. Later on the elbows.

Leukopenia and polymorphonuclear percentage reduction appear by the second day

CLINICAL CHART ONE HUNDRED CASES OF DENGUE, FEVER

L	analysis by type	analysis as a whole
Day of disease	100 S	Average 100 cases
1-1-1-	Average 52 tasks X X	Rash 63 %
	1 1 100	Adentis 625%
2	0 2	Gyanosis 17 %
3	16 8	Egistaxis 10 %
4	20/20	
5	20,16	Hyperae thesia 3 %
6	Saddle + Black 8 6	Diarrhea 22
7	/ 20	Jaundice 18 Herpes labialis 18
8	Type 20	Herpes Labialis 1 %
		i
	Total +- Rosh 688	BLOOD WORK
	Total +- Adentis 52 8	(average)
		White Blood Cells 4300
		Polys 595%
	Average 18 tasks	Large Mones 78%
	100	Large Mones 78%
2	00	Iransitionals 17%
3	10 2	Eosinophyles 05%
4	35 30	
5	Non Saddle Dack 10 4	WBCs as low as 2800
6	4 2	Polys as low as 38 %
7	Type 2 4	Lympho as high as 53 %
8	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
	Totalt-Rash 598	
	Total - Adentis 42%	

Pic 205 - Dengue Analys s of Symptoms from 100 cases oc usring in an ep demic at St. Thomas V I (After Lane from U & Naval Medical Bull (1) 1)

Convalescence is apt to be protracted being especially characterized by malaise and nervous depression, and sometimes neurasthenia

Chinical Types—In different epidemies it is noted that .ome one chinical feature may seem outstanding. Of these we may note.

in the epidemic in Cairo of 2594 cases that 50 deaths occurred from pulmonary and cardiac complications

DIAGNOSIS

No definite laboratory test has been developed for the identification of the dengue virus and the specific diagnosis rests largely upon the churcal observations and examination of the blood

The two diseases with which dengue can be most easily confused are interest and yellow fever. In fact, when the great pandemic of influenza (1800) first made its appearance in France many regarded it as an atypical

form of dengue

The respiratory involvement of influenza and the eruption and comparatively slow pulse of dengue are the principal points of difference it must be remembered that affections in the tropics diagnosed as influenza have abova but slight respiratory symptoms the cases being more of a nervous or intestinal type. The eruption of dengue may fall to appear or be missed in the study of the case. The blood findings should aid in differentiation from influenza as is also true of yellow fever a disease which likewise has blood findings of practically a normal character Other than the blood picture we have in yellow fever (1) albuminuma coming on about the second day and () jaundace appearing about the third day. In dengue the cruption appears from the third to the fifth day Albuminum; a usually absent in dengue. However febrile albuminum; as noted as a complication by de Langen (1936 Langen) (1936).

albumnuria is noted as a complication by de Langen (1936)

Dengue may be mistaken for measles hut the early coryza Koplik
spots and marked rash first appearing about the face should differentiate

In scarlet fever the rapid pulse angina and leucocytosis should be sufficiently differentiating

Confusion with articular rheumatism may arise when the pain about wrists knees and ankles has been mistaken for true foint involvement

The headache and backache of smallpox may he confusing until the eruption about the forehead appears

The leukopenia of dengue is the

main differential point in these first a days of doubt

Fapataci fever and Ruft Valley fever caused by immunologically different vames show symptoms of the leukopenn as observed in dengue The Seven day fever of Rogers in India and Six day fever of Deeks in Panama and the Five day fever of Van der Scheer in Batavai may closely resemble dengue and are probably either dentical with dengue or due to closely related viruses.

PROPHYLAXIS AND TREATMENT

Prophylaris —This would seem to rest entirely upon the question of destruction of mosquitoes and prevention of the infected mosquito from biting an individual. In dengue the virus is apparently in the blood for 3 days so that screening of patients is necessitated for this time and for a longer period than for phelibothomus ferm.

and knees may be involved or the rash may cover thickly the entire body. A carmine flush of the palms of the hands and soles of the feet is not uncommon. A furfuraceous desquamation, with much itching at times follows the cruption. The so called primary cruption is nothing more than an initial flushing of the face it is ephemeral. The true dengue rash may also be quite ephemeral, but usually it lasts for 2 or 3 days, or rarely 4 or 5 days.

The Nervous System —Besides the headaches insomnia and depression are common and may extend through convalescence Apathy is marked

The Blood -The disease produces little or no change in the ery throcytes or haemoglobin, but one of the most constant features of the disea e is a marked leukopenia, which was emphasized by Stitt (1906) Reports however do not entirely agree as to the duration and degree of the leukopenia or as to the type of cells involved. Stitt frequently observed a leukonema of about 4000 from shortly after the onset with a reduction of the polymorphonuclears to about 45 per cent. During the attack the composhies are decreased but there is an increase during convalescence Simmons in an experimental inoculation of 80 cases of dengue in white American soldiers in Mamilla found that all developed leukopenia that the leukopenia usually began by the second day and progressed to a low point of about 2000 cells on the fourth or fifth day after onset. The counts returned to normal levels several days later than did the temperature. The leukopenia was produced by a decrease in both the mononuclear and the mature neutrophilic polymorphonuclear cells The latter showed marked degenerative changes during the fever and decreased numerically from a normal of about 3000 cells to levels as low as 300 cells. Coincident with this decrease in the mature cells, there was a marked increase in the immature granulocytes, which often began on the day preceding the initial fever and lasted throughout the infection This early shift to the left he found was a constant reaction which often made it possible to anticipate the on et of the disease in the experi mental infections

Mortality -- Very few deaths have been reported except among infants and aged persons when the condition has generally been complicated

Sharp and Hollar (1935) record one death per 1000 cases reported by Robertson (1905) in an epodemen at Brisbane, and one death per 1000 reported by Schrumpf Pierron at Cairo in 1929. In 193 in an outbreak in Greece, the death rate reported by Pontano was 1 per cent while Cardamits gave the mortality rate as 1 to 6 1000. Griffiths and Hanson state that in the records of the City of Athens Greece for August 1938 32 6 per cent of the deaths were certified as due to dengue. In Piraeus where it was estimated that 90 per cent of the population became infected 37 7 per cent of the deaths were reported as caused by dengue flowever, during this contribute of the deaths were reported as caused by dengue flowerer. Wathing this contribute of the deaths were reported as caused by dengue abnormal death rate for dengue fever. Wash and Hilmy (1938) reported abnormal death rate for dengue fever.

A alloyatus on endemac cases of dengue m Medan Sumatra and then sent them to the Colonial Institute in Amsterdam where they were re fed on volunteers where fever had never been previously reported All of the volunteers subsequently developed dengue but it was shown that the same virus in the same bath of mosquitoes produced different types of fever in different individuals. In one case it showed a typical saddle back temperature in another a continuous fever lasting 7 days. From this it appeared that the Eyee day, fever of Van der Scheer and the Seven day fever of Rogers are not distinct diseases.

There has also heen described a condition called the red fever of the Congo which was formerly thought to be a form of yellow fever Findlav has more recently emphasized that it much more resembles dengue than

yellow fever

It should he horne in mind that there is a form of leptospirosis which has been encountered in Japan which is caused by Leglospiro hebdomadis Its differentiation from dengue was made possible by the discovery of

Leptospira in 1918 by Ido Ito and Wani

Rait Valley Fever (Enzosuc hepatitis) is an epizootic disease of sheep caused by a filtrable virus described by Daubney Hudson and Garnham in 1931. During the study of a severe epidemic in Kenya British East Africa it was noted that the native shepberds and later Europeans in contact with the affected animals developed a short illness resembling dengue. These investigators also produced the disease in a volunteer by inoculation with the blood of an infected sheep. Since that time a number of laboratory workers in this country and abroad have contracted the disease while studying the virus

The disease can be transmitted to cattle (a small or poolut of natural infection is recorded) goods certain species of months; arts mere and other trails Indeate. So it recorded to the contact the month of the contact of the trail indeate of the contact of the trail indeate of the properties of the trail indeate in the contact of the trail indeate in well as by subcutaneous or interpersional aspection. There is some evidence to suggest that monoquivous of the genus Homeon as et as severes but this has not been definitely proved. The characteristic pathological les on in lumbs and also in modulated mere noclusions in the heavistic reliff the very Standed section as show accided le untransculent or columns in the heavistic reliff the very Standed section on show accided le untransculent.

Marken wand finding (690) obtas eds. fased sense op estrain of Reit Valley for er v rus by the mysterios of mannes serias unto a namal prior to an intracerbeal moculation of virus. Some of the ne e cells showed intransclear inclusions simil r to the sp oduced by the new otropic type I yellow fever virus. They suggest that the restre ming action of specife antibod es may peed on neucotropic variation of other experiences of the specific properties of the specific preservation of the specific properties of the specific properties

Immun ty—The serum of convalencent an male and man contains—irus neut ali 1 g ant bothes for a ve 1 months after recovery but the ammunity is n t permanent B own and Findity have demonstrated complement fi mg antibod es which a c appar e tly spec fic for Rift Valley fever and whe he they found to pers st for at le st 6 months

916 TREATMENT

Because of the high incidence of dengue particularly among American troops in the Philippines, attempts have been made by Army medical officers to develop a prophylactic vaccine. No protection, however, has been demonstrated by such measures—as blood rendered non infective by free-ling drying and storage, and saline suspensions of macerated, infected insects rendered bacteria free by the addition of phenol or formalin

St John and Holt also prepared a prophylactic against dengue by extracting the liver and spleen of dengue infected monkeys. However, it did not protect volunteers from an experimental infection later, although

some of the attacks seemed to be milder

Treatment - The malase and depression are generally so great that the cutter keeps his bed voluntarily. A light diet is indicated although the anorexia is so marked that it is difficult to persuade a patient to take food. Cold spongings, provided the patient is not disturbed by being moved are of value for the insumua. Phenacetine or aspirin may be given for the relief of the headache and backache. It is rarely necessary to give morphine. During convolescence tonics are indicated and if there is any condition where a good wine is of value it is this to counter act the terrible depression. It has been suggested that adrenal insufficiency may account for the asthenic portracted convolescence and from this standpoint adrenalin has been recommended. In the Athens epi demic urotropine was found to be of value when given in full doses in the early stages.

DENCLE LILE FEVERS

There are a group of febrile conditions which in many respects resemble epidemic dengue feer and which occur more frequently in sporadic as es but which differ from one another in their duration rather than their symptomatology

Van der Scheer described such a fever in Batavia, with a course of 5 days. This became known in the Dutch East Indies as the Fielder

le er of Van der Sieer

Deeks in Panima described a very similar condition with a course of odays Rogersin Calcutta one lasting 7 days, Baermanian Delhi Sumatra one lasting 9 days. Others have been described in different parts of the world varying from 3 to 10 days. In the disease described by Deeks in Panaina there was a continuous fever for 6 days and an enlargement of the spheru which wa said to differentiate it from dengie

Delangen (1936) points out that the Evre day fever of Van der Scheer is spread widely over the entire fast Indica and that it; impossible and unnecessary to differentiate all these dengue lit e for ers from one another as they all have the same symptomatology but only differ locally in duration. Thu he points out that in the same place the attacks may be of different duration and that in Batavia Dey not only have the Five day fever of Van der Scheer but semilar types lasting anywhere from 2 to to days. The virus is transmitted by the same mosquitoes and is filtrable. Moreover, Singlers and Binger fed morquitoes. Acids aegypt and

A obspectus on endemic cases of dengue in Medan Sumatra and then sent them to the Colonial Institute in Amsterdam where they were refed on volunteers where lever had never been previously reported. All of the volunteers subsequently developed dengue but it was shown that the same virus in the same batch of mosquitoes produced different types of fever in different individuals. In one case it showed a typical saddle back temperature in another a continuous fever lasting 7 days. From this it appeared that the Five day fever of Van der Scheer and the Sex end ay lever of Rogers are not distinct theseases.

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inclusions in the hepatic cells.

the displace consists of the displace consists

Im unity—The serum of con alescent animals and man contains arus neutralizing and bod es for several months after provery but the immunity is not permanent Broom and Findlay his e demonstrated complement for gratified with the are apparently specific for Rift alley fewer and which they found to persist for at least 6 months.

Francis and Magill (1935) have shown that the inoculation of insusceptible animals such as the rabbit also results in the development of virus neutralizing antibodies

Marschall (1942) has compared the histological changes of the liver in mice and humaters indeced with Rift Velley Tever view with those seen in Yellow Fever. It finds that there are striung sumbarities in that the Councilman bodies resulting from eathered necross may dominate the picture in both infections and the inter nuclear inclusions are also similar. However, he points out that there is hittle changer in the diagnosis of yellow Fever being complicated during the examination of human specimens of liver obtained by succeedance. He points out that Rift Valley Tever produces only a middlinetton in main.

The diagnosis of Rift Valley fever depends upon the demonstration of the virus in the blood by mouse inoculation in early cases or of virus neutralizing antibodies later in the disease. The clinical parties resembles that of indiatena deepue or yellow fever. The virus of indiatena however is not present in the blood and the viruses of dengue and yellow fever are not pathogenic for nice on intraperational inoculation. There is

no cross immunity with the viruses of dengue or yellow fever

Bwamba Fever —Smitthorn Maha By and Paul (2012) have encountered in Uganda a fever which they believer as a chincal entiry. They report that the disease is characterized by rather sudden onset (ever he-wlache and backache. The symptoms persist for about 5 to 7 days and subande wishout sequelae. They have not observed fatal cases. Nine strains of a filtrable virus were isolated from the blood of opatients suffer my with the disease. The original zero of the patients failed to neutrinize the virus whereas convalenced zero contained neutralizing antibody against 13. The virus was anathogene for and caused death of mice by intersectival or intransal inoculation. It caused non fatal febrile illness when give on intracerebrally in the virus in muce were applied and the properties of the virus of the virus of the patients of the virus of virus of the virus o

Philebotomus or Pappatan; Fever, Sandig Fever, Three-day Fever—
Philebotomus for er was first described in Dalmatus Later it was proved
to be very widely distributed. It was shortly alternards observed in
the Balkans Italy Portugal and all the countries bordering on the
Mediterranean It also occurs in British India. China East Africa and
South America. Recently an outbreak occurred in northern Argentina.
Its range appears related to the distribution of the sand fly Philebotomis.

Manson Bahr points out that where Pheboteners is absent as in Bermida the free is not found. Delargen and Laberstein (1985) state that it is not present in northern ladie. During the Great Wart was prevalent in Gallipoli Salonica the Agan Islands Egypt Palestine Syria Iraq and India. In India at has been encountered up to a height of 4000 ft. In the Western hemisphere it has recently been reported in northern Arrentina.

Etiology—This disease which is often called three-day fever on account of its running its course in this period is caused by a filtrable virus (Doer 198). This virus only scena to be in the blood of the patient's peripheral circulation during the first 24 hours of the illness. Blood abstracted after the end of the second day and injected into a well person fails to reproduce the disease. If the blood is filtered through a Pasteur candle F the filtrate will set up an attack, just as well as the unfiltered blood in this respect being like dengue and yellow fever.

Shortt, Rao and Saammath (1936) reported the cultivation of the virus of sandily fever upon the chorio-allantoic membrane of embryo chucks and Shortt Pandit and Rao (1938-39) have confirmed the chucks and They consider that the proof of cultivation of the sandily

fever virus in the chorio allantoic membrane depended not only upon the production of focal lesions in the egg but becau e the serum of patients convalescent from sandfly fever was able to neutralize the lesion producing agent in the material. Of 6 convalescent sera tested, all but one inhibited growth of the virus on the membrane The controls with normal human serum all showed growth of the virus while the convalescent sera by themselves gave no growth By infiltration experiments through gradu ated membranes the size of the virus f

diameter Anderson (1941) has attempted to diagnose Sandfly fever by making cul tures of the virus in the chick embryos by the technique described above by Shortt Samples of the blood of 132 patients suspected of having Sandily fever were examined Positive cultures or results were obtained in 78 doubtful in 14 and negative in 40 Obviously little importance can be attached to negative results

was determined to be about 160µµ in

Transmission -The transmitting agent is a sandfly or moth midge Phlebotomus papatassi. This midge as is true of the psychodid family to which it belongs is very hairy. It has long slen der legs and narrow wings The probo cis is as long as the head and the

lancets project beyond the labium The female alone bites which act takes place chi fly at n ght cool moist shady places away from sleeping rooms being preferred by the

insects in the days me The insect is a persiste t victous feeder difficult to escape from as oning Fig 206 -Pht b f m to its slender size mosquito nets usually employed offer no protection. It takes from 6 to 8 day, after feeding on a patient in the fir t

mal (Aft D re t 1)

day of the fever before the midge is capable of transmitting the disea a Doore thinks that the papataci virus may be transmitted he ed tarily by the insect to the egg Whittingham and Rook confirm the transmission from generation to generation At present of the genera of the 3 fam hes of mid es only Phlebotomus is know

to tra smit disease P p palasis transmits phlebotomus f v r in the Balkan minutus has been reported as the host at Aden Another species P permiciosus is als sa d to transm t the d sease. However there has be much confus on in the differentiati n of the species and s m entomologists believe that P paperassi is the speci s commonly concerned in transmission

These moth midges are 2 mm in length and ha the body dens by cove ed with long yellow hairs The second longitud nul v in has three di tinct branches The antennae have 16 restricted joints and the profosors is as long as the head. The spicies of Phlebolomus are separated by slight vari to a n wi g venation palpal lengths etc thus the second segment of palm of P papatasse 1 a little longer than the third one while with P per cooss these segments are of equ I lengths. In P minul s the second segment is only half the length of the third. The insect lays about 40 eggs in d mp dark places The period of metamorphosis from egg to insect is about one or two months according to temperature

Francis and Magill (1935) have shown that the morulation of insusceptible animals such as the rabbit also results in the development of virus neutralizing antibodies

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Phlebotomus or Pappataci Fever, Sandfly Fever, Three day Fever —
Phlebotomus fever was first described in Dalmatia. Later it was proved
to be very widely distributed. It was shortly afterwards observed in
the Balkans. Italy Portugal and all the countries bordering on the
Mediterranean. It also occurs in British India. China. East Africa and
South America.

Recently an outbreak occurred in northern Argentina.
Its range appears related to the distribution of the sand fly. Philebotomis.

Maisson Babr points out that where Philodomers scheent as in Bermida the fever is not tound. Delianges and Letterstein (1959) state that it is not present in notine India. During the Great Warst was prevalent in Galippib Salonica the typan Island Egypt Palestine Syria Iraq and India. In lindia at has been encountered up to a height of acoust. In the Western hemisphere it has recently been reported in northern screening.

Ettology —This disease which is often called three-day fir er on account of trouming its course in this period is caused by a filtrable virus (Door 1908). This virus only seems to be in the blood of the patient a peripheral circulation during the first 14 hours of the illness. Blood abstracted after the end of the second day and impected into a well person fails to reproduce the disease. If the blood is filtered through a Pasteur candle F the filtrate will set up an attack, just as well at the unfiltered blood in this respect being like dengue and yellow fever.

Shortt, Rao and Saammath (1936) reported the cultivation of the virus of sandily feer upon the chorio aliantoic membrane of embryo chicks and Shortt Fandit and Rao (1938-39) have confirmed the cultivation.

They consider that the proof of cultivation of the sandily

dengue is that neither is said to confer any immunity for the other disease The distinctions of enlarged glands and break bone pains are often advanced as characteristic of dengue and not of sandfly fever. Stitt never observed other than slight glandular enlargement in dengue cases However in endemic dengue in the East Indies deLangen states general swelling of the lymph nodes may be striking

Treatment is purely symptomatic Aspirin has proved valuable for the relief of the headache Morphia is rarely necessary to control the pain The patient should be advised to rest for several days following the subsidence of the fever Otherwise the asthenia is hable to continue for a longer period. The prognosis is entirely favorable. No serious complications are known to occur. No deaths have been known to have

been caused by the infection

Prophylaxis depends particularly upon the prevention of the bites of sandflies Unfortunately a mosquito net having a mesh sufficiently small to keep out sandilies is almost intolerable for u e by a white man in a hot climate. Nevertheless as the Pilebolomus does not usually By higher than to ft the removal of inmates to the upper story is usually a very effectual preventive measure Repellants such as camphor and oil of citronella are of value in keeping away the midges Electric fans or currents of air are also frequently very effective in ridding quarters of Phlebotomus Attempts should be made to eradicate the breeding places of the fly which have already been discussed

Sellar Fever - Jack (1937) has described an infection in the Delhi Meerut area in India which he regards as a disease sus generas to which he gives the name of sellar fever. He points out that the clinical picture suggests a re emblance to the sandfly dengue group but there are many definite differences However O Meara (1038) who has also studied this fever in the same areas points out that the word sellar is saddle and that saddle back fever is simply another name for dengue

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Philostomus larvae due out in dry soil and very set earth a unfavorable. Moderat moviture and protection from light seem necessary for their development. I have remained dead insects all o seem to make good breeding places. It is in cards of old damp back or stone walls that the fernal most often deposits her ggs. Gaves are also also places are cracks an walls on the ground surrounding buildings these should be filled in and made inaccessable to the midge. If breeding is thus prevented 200 to 300 feel from the bouse it keeps the female Philostomus from getting a blood freeding on account of the distance.

Blood seems necessary for the fertilization of the eggs but lizard blood seems more common in the stormach of P minutes than human blood. They have all observed to feed on other repti an blood. The female insect has been kept alive in

captivity up to forty ix days

Cases of phlebotomus fever first appear in the late spring and the disease becomes epidemic during the summer. An attack produces a marked immunity. The disease has chiefly heen studied in the Balkan States but undoubtedly it is widespread. It is almost never fatal so that we know nothing of its pathology.

Symptomatology —The symptoms of phlebotomus fever answer very well for ca es one sees in an epidemic of dengue fever in which instead of the saddle back course of fever we have a three day primary rise and then a fall to normal without any secondary fever rise. Cases of phle hotomus fever are occasionally reported where the fever continues seven

or eight days

The symptoms as usually given are as follows. After a period of incubation of from 3 to 7 days there is an abrupt enset with congested face and injected conjunctivae Manson Babr says the conjunctivae are sometimes so injected that they have been likened to those of the mastiff There is pain in the head eyes and back. There is marked malaise with great depression of spirits. There is anorevia, with coated tongue and rarely vomiting and diarrhoea. There may be some congestion of the pharyny and even a slight brouchitis. It may resemble influenza so closely clinically that a synonym is summer influenza. The liver and spleen are normal DeLangen emphasizes that the nervous system may be most intensely attacked and may form the center of the chinical manifestations The patients may feel very ill and be weak and anothetic and suffer from intense mental depression Epistaxis is rather common There is a leukopenia and polymorphonuclear percentage decrease two points which are chiefly advanced in its chinical differentiation from dengue are (1) slow pulse a bradycardia and (2) usually only a days of fever and absence of eruption However bites of the sandily may cause a considerable amount of irritation resulting in hyperaemia and even in oedema Some writers have even reported not only a hyperaem a but an exanthema. However in such cases it was noted that it appeared at no fixed period as with dengue fever

The dengue like fevers of Indus are practically identical clinically with phlebotomus fever. The usual idea is that dengue epidemics are far more explosive in character than is true of epidemics transmitted by the sandily. The strongest point in differentiation of sandily fever and

Chapter XXV

DISEASES DUE TO RICKETTSIA

(The Typhus Group of Fevers)

Introduction -Through epidemiological pathological and immunolog ical studies we have been enabled to differentiate three important groups of human disease caused by nekettsiae (1) the typhus group (2) the Rocky Mountain spotted fever group and (3) the Japanese river fever group The Rickettsia of O Fever is also distinctive The typhus fever group includes the epidemic or louse borne fever and the endemic flea borne typhus or murine typhus so termed on account of the natural reservoir in rats. The Japanese river fever group also known in Japan as kedam disease or tsutsugamushi disease embraces several more or less closely related mite borne infections which have been encountered in Southern Asia Japan Formosa and Oceanica The Rocky Mountain spotted fever group includes the forms of the disease transmitted by ticks-as Rocky Mountain spotted fever of North America (eastern and western types) Sao Paulo exanthematic typhus of Brazil probably fievre boutonneuse of the Mediterranean countries and Northern Africa and South African tick bite fever. Fievre boutonneuse of the Mediter ranean coast is apparently caused by a strain of Rocky Mountain spotted fever virus modified by residence in the dog and in the dog tick. At least there may be complete cross immunity between the organisms of these two diseases although they are clinically different Certain immunological reactions however indicate that there are minor biological differences between the two viruses and Rocky Mountain Spotted Fever vaccine does not protect against fievre boutonneuse

Rickettsiae Pathogeme for Man—The term Rickettsia proud eki was first applied in 1916 by Rocha Lima to the cellular inclusions observed in the intestines of lice which had fed on patients with typhus lever He proposed this name in honor of the scientists Ricketts and Provazek

both of whom succumbed while studying the disease

Von Prowazek formerly thought that the Rickettsiae were probably closely related to the protozoa Morphologically they resemble small pleomorphic bacteria. How closely they are related to bacteria is still not entirely clear but there has been much evidence which has made it appear advisable to separate them from the true bacteria on the one hard and from the filterable viruses on the other. They differ from most bacteria in being able to grow only within living cells and in this respect they are more closely related to the filterable varies. However, they differ from many of the filterable vurbuses in that most of them are slightly too large to pass through fine bacteriological filters. The virus of Q Fever is the only pathogenic one known to be definitely filtrable.

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Chapter XXV

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924 Q FEVER

The Rickettiane are encountered in the tissues of arthropods as well as in man and other mammals and live and multiply only within the cytoplasm of living cells. Some writers however, include some of the similar but extra cellular organisms found in arthropoda as Rickettiane. None of them have here cultivated upon the usual bacteriological media.

Morphologically the organisms are diplococcoid and show great variation in size and shape, from almost invisible particles to bodies approach ing 2µ in length. Stained with Gemsa they take a purplish tint and with Castaneda s stain they are light blue in color. The Machiacello stain is most satisfactory. These tints are unlike those of ordinary bacteria stained by these methods. They are Gram negative. While not cultivable on ordinary media, they grow in the cells of tissue cultures. I lotz Smadel. Anderson and Chambers (1943) have reported upon the morphological structure of ricketisae with the aid of a type B. R. Ca electron microscope.

Plasma clot ussue cultures were first obtained by Wolbach and Schlesinger of the Rickettsia of Rocky mountain spotted fever. Subsequently the choric allantoic membrane of living chick embryo and the Maitland medium with minced chick embryo in a mixture of guinea pig or rabbit serum and Tyrode solution proved more satisfactory media for culturation.

It has been suggested but not proved, that the genus Rickellina was originally adapted to plants, later becoming parasites of mites feeding on plant juice and subsequently infecting rodents on which the mites fed From such infected rodents hee ticks and fless became of impor

tance in rickettsial epidemiology

Speces —The important species which have been demonstrated as pathogens for man are as follows (1) R from ch the cause of typhis fever. Two different varieties of this organism have been recognized—R prona ch the cause of endemic European louse borne typhus and Rocky Mountain spotted fever and also the name given to the infective organism of several other diseases which may be regarded as strain variants (3) R orientalist (Nagas) R instingainmin (Ogata 1931) and R miponica (Sellards 1923) the names which have been given to the entilogical agent of the group of mult borne diseases which occur in the Far East. These diseases have many features in common with those of typhus and Rocky Mountain apposted fever but are characterized by the presence of an initial local lesion and the organisms appear to the distinct immunologically.

O Fever—Derrick (1937) and Burnet and Freeman (1937) have all o reported a rickettsa like organism growing inside but also outside of cells as the cause of O fever in Australia Derrick (1938) has named the species R burnelli The bandicool Isodon macrieris is believed to be the natural reservoir of the infection which is probably transmitted by a tick Haemaphysalis humerosu (See also page 973)

hy a tick Haemaphysatis namerosa (oce also juge 9/3 /
A similar organism has recently been found in wood ticks Dermacentor

A similar organism has recently been found in wood that Dermittening anderson: in Montana (Parker and Davis 1938) Dyer (1938) has reported a case of prohable laboratory infection with it. The disease has

been named 'Nine mile fever Pinkerton (1940) reports that there is no cross-immunity in guinea pigs between the organism of this disease and that of typhus or of spotted fever

More recently Cov (1940) has pointed out the close relationship of this milady to that of Q fever of Australia. Tests which he has carried out with guinea pigs have shown that American Q fever shows no cross immunity with Rocky Mt. potted fever Brazilian spotted fever bouton news fever or epidemic and endemic typhu on this infectious agent which is filter pa sing and isolated from ticks and later by Cox has e definitely about the title there is complete cross immunity with it and the organism Q fever of Australia.

Cox has suggested the name of Reckellsia disports for the organism. It is sufficiently the organism in tissue cultivated the organism in tissue cultivated the organism in tissue cultivate of the developing chick embryo. The best results were obtained with flashs containing chick jolk sap it sue suspensions in filtered human ascitic fluid. From such a source by a fractional centrifugation practically pure suspensions of R disports suitable for agglutination tests have been secured. Sea from monkeya and rabbits recovered from American Q fever agglutinate suspensions of R disport a but fait to show agglutinis for Brueella cheritis. Batt fuldrense and the ONL ON, ON, and NL strains of Process.

In infected guinea pigs ricketisae were found in great numbers in the inflammatory exudate of the sirn and in the cellular exudate frequently found covering the spieen. They were also present it large numbers in the spieen substance and in the tunica and polar fat of the testes. They were often extracellular but in many cases abundant intracyto plasmic forms were found. The cell nuclei were not commonly invaded but in a number of cells in which nuclei appeared to be vacuolated rick extral form, were seen with in the vacuoles.

Rickettsia like Organisms - Many rickettsia like organisms found extracellularly in the intestine of arithripods and presumably, non patho genic have been reported. Wobbach (1930) has listed 39 nonpathogenia nickettisal organisms in 14 species of arachinids liticks mite and spiders) and in 22 societies of hexapods (smeets.) including numerous nor blood sucking irrects as well as lice ticks and midges. Among these he lists R poli is R quantums R a-onfinea of the body louse and R midophagi of the sheep's ked. These are not intracellular and he does not include them in his classification of the family. Rickettsparges

Other Diseases —There is some evidence for believing that R pedicula may be the cause of trench fever. Opinions however differ in this connection and Zin ser (1940) states that the evidence is far from being convincing. See Chap. XXVIII (Trench Fever)

Rickettsta like organisms have also been found by Siler and Sellards (1938) in about haif of the mosquitoes leder acypti fed upon patients with dengue fever. They however did not suggest a definite ethologic relationship of this organism to dengue fever and such a relationship has not yet been established. 926 PSITTACOSIS

Trachoma -- Other organisms which should not be classified as Rickettsia recently have been reported as pathogenic for man Cucnod and Natof (1937) believe that their experimental evidence shows that trachoma is caused by Rickettsia. They collected trachoma material from a patient and injected it into the testicle of a guinea pig a culture of Rickettsia being obtained in this manner. Lice were then injected with this culture. After the culture material was passed through a series of lice it was inoculated into the conjunctiva of an ape, which developed chincal trachoma. One experiment consisted of injecting the conjunctiva of a blind human eve with this Rickettsia culture in lice This was followed by clinical trachoma, confirmed by labora tory and microbiologic tests. Poleff (1917) has confirmed this work in Madagascar and Thygeson has studied the virus of inclusion con nunctivitis in the United States Foley and Parrot gave the name R trachomitis to the organism apparently described as Chlamido son trachomitis [Halberstaedter and Prowazek 1907] while Donatien and Lestogard regard it as identical with R consuncts the Coles of ruminants (sheep and cattle) Burnett (1937) classifies this Rickelling of trachoma in a separate group and states that no bodies are present in trachoma other than the well recognized Halberstaedter von Prowazek bodies Donatien and Lestogard (1038) believe these bodies are the initial ones in the cycle of the organism. However Bengston (10:8) questions whether the various stages of the inclusion bodies in trachoma are nel ettsial in nature

Pattacosis —Although a number of reports appear to have established the filterability of the infective agent of Pattacosis Lillie (1939) Blane and Canit (1935) give evidence for regarding postlacosis as a rickettant disease. Laidlaw (1936) using graded colloidon membranes gives the suc of the infective virus particles as o 25µ and 1 zarais Edde and Meyer (1937) o 2-0 3µ. The virus of pattacosis will pass Chamberlands L L2 and Setz E. & filters. Nevertheless the dimensions of the particles of the virus given suggest that it is visible. Leventhal (1930) Coles (1930) and Lille (1930) all fourd such bodies in the infected spleens and livets of parrots with pattacosis. From the names of their discoverers, they have become known in literature a 1 CL bodies.

In ections stained with Geneas a solution they appear as truy blue spherical or not doced or backlary forms Jung either in the cytioplasm of certain mononuclear cells or free in the tissue spaces. Rivers (1931) found small cocci or short bacellary structures 0.2-0.5 µt in diameter or length. Lille has, propo ed the name R prifers for them. However Beetson and Blood (1934) did not find breather, bodies but round bodies which might measure µt in the monocytic cells and which they regarded as made up of elementary bodies. It has been suggested that they are plasmodal inclusions analogous to the Gauriero bodies in vaccinia and not rivettinal. Enders (1940) takes this view especially because an arthropod (misect) vector thas not been demonstrated.

Lymphogranuloma Ingunale — Miyagawa (1935) first reported Rick ellin, in 20 human cases of Chmatic bubo (Lymphogranuloma inguinale)

the organisms being found mostly in histiocytes but also sometimes in leucocytes glia cells and lymphatic cells The organism was cultivated upon chorio aliantoic membranes of chick embryos. The presence of these rickettsiae in this disease have been confirmed not only by several other Japanese investigators but recently by Nauck (1937) Mauro (1937) Findlay (1938) and others Brumpt (1938) on account of this recent work and after examining Miyagawa's specimens has suggested a new genus and species for this Rickettsia-Miya an anella lymphogranulomato sis nov sp

Mosing (1936) an ass stant of Weigland working in Wei 1s laboratory has proposed the name of R weigh nov sp for an extracellular Richettina which he says is larger than Ricketts a proug eks and that he found in the intestine of lice and that produces a febrile infection in man consisting of a fever which relapses on the third day. The

Weil Felix reaction is said to be negative

Herzig (939) reports that among 40 to 50 people in Weigl's laboratory upon whom lice were fed for the purpose of preparing anti typhus vaccine a number developed fever and a large percentage of the hee showed rickettsial infection. The organisms were extracellular and were said to resemble R pediculs. It was stated that Rickettsia could be seen in the blood of the patient in large numbers This is the first report in the literature in which large numbers of rickettsiae have been reported as being present in the blood of human beings buch a statement must be regarded as unusual and has not yet been confirmed. Many authorities do not regard any of these organisms as Rickettuia

Epidemic Typhus Fever DEFINITION AND SYNOVYMS

Synonyms - Jail fever ship fever putrid fever petechial fever typhus exanthematicus Ger Fleckfieber Fr Typhus exanthematique Sp El tabardillo Ital Typho esantematico

Definition - Typhus fever is an acute infectious disease caused by Rickettsia proud che There is a fairly abrupt onset with a continued fever lasting about 2 weeks followed by a critical fall or rather rapid lysis of temperature About the fifth day a rose spot eruption first appears about the loins and abdomen later on extending over the trunk and extremities The rash tends to become petechial and stands out rather prominently on a general cutaneous mottling. A stuporous state is a marked feature of the disease. It is transmitted by the louse Pedicu Ins humanus

HISTORY AND GEOGRAPHICAL DISTRIBUTION

History - Typhus fever has been one of the great epidemic diseases of the world Hirsch notes that its history belongs to the dark pages of the world's story at times when war famine and misery of every kind are present. It is reasonable to suppose that many of the pestilences of ancient times and the Middle Ages were typhus fever This disease was prevalent among the Spanish soldiers at the time of the conquest of Granada and the designation of the disease then used (tabardillo) is the one now given typhus fever in Mexico.

The disease was first described with sufficient accuracy by Frascatoro in the 16th century to enable us distinctly to differentiate it from plague

the stuporous states of the two diseases having previously caused them to be confounded In England, in the 16th century the disease was very prevalent in the jails and court officials attending the trials of prisoners often contracted the disease and died hence the designation black assizes ' During the Thirty Years War in the 17th century, typhus fever spread over central Europe Typhus fever was very prevalent at the time of the epidemic of plague known as the great plague of London and it is a matter of practical interest that the two diseases were not infrequently confounded by medical men. The disease persisted in epidemic form throughout the duration of the Napoleonic wars and did not begin to subside until the conclusion of peace in 1814 after the battle of Waterloo. This enidemic of typhus fever was said to have been the severest one ever recorded on the continent. The general poverty and distress which resulted from the war evidently aided greatly in the spread of the disease not only among the troops but throughout the civilian population

In earlier years from the 16th to 19th conturnes numerous epidemics occurred in England but in recent years the disease has gravely decreased. During the period 28% to 1838 there were 2.29 cases but from 1899 to 1973 there were only 190. It reliand there were very severe epidemics in earlier years. During the 19th century there were six lever epidemics in earlier years. During the 19th century there were six lever epidemics in earlier years. During the 19th century there were six lever epidemics and outbreaks are still hable to occur in 30me districts of Ireliand which are recarded as endemic center.

In the United States and Canada to phus also prevailed in certain centers during the

soft century and there were evere epidemics following the Irish Immigrations in 1864Ar In Merica the disease became epidemic in 1850Blumg the 1964 century also there were numerous epidemic with high mortally reported from labarishio the Menican disease. In South America, typhus was probably imported from Span to Peru at a very early period, where the became cell known under the Spanish name of tabardillo. It continues to prevail in this country and Chile at the present time.

Serban and Other Epidemics — Epidemics of typhus have very fre quently been associated with war. In fact seiver epidemics have occurred during practically every great war in Europe with the exception of the France Trussain war in 1870. In the World War the epidemic which raged in Serbia in 1915 was one of the most severe which has occurred in modern times. It was characterized not only by its magnitude but by its high virulence and high mosticality. During the height of the epidemic the number of new fever cases entering the military hospitals alone, reached as high as 3500 per day and the number of reported cases among the civilian population was approximately three times this number localities between 30 and 60 per cent. Over 1500 one per periods in different localities between 30 and 60 per cent and in complicated cases sometime reached 70 per cent. Over 1500 oscillations of this three occurred as of training there occurred an epidemic of relapsing fever delapsing fever feabaging feathaging feathaging fe

Poland has for many years been recognized as an endemic center of typhus. The dises a became epidemic a am in 1916 when the chief area at first affected has the go enumental district of Warsan at the time occupied by German troops. In this district, which had a population of nearly two and a balf in liton 26 oog cases were

reported in about 12 months. In Congress Poland and Galic a combined the cases reported for 1916 were 34 538. The measures taken against the epidemic in 1916 and 1917 failed to check its spread but the hope was expres ed that the epidemic would disappear in the summer months. The summer of 1917 however accomed to have little effect in red soing the number of cases of the disease and rathe year 1917 they numbered 43 840 In 1918 when Poland became an independent state an extensive anti typhus campaign was initiated. During the first year there were some 221 000 cases notified with nearly 20 000 deaths the mortality howe er being only 8 6 per cent



Fid 207 -Typhu f v Co ar port d per roo ooo population n E t rn Eur p a 1936 (End m 1 g 1 Int II g n Ser wof th Leagn f vations)

At the close of the Word War an extent e ep demic brok ut n Russia and Rum n a In Rumania t caused tome 800 000 deaths. In Pussia while the e were on accurate stat stice obtainable it was estimated that sime 5 000 000 c see of typhus fever occurred bein en gig and tozz. The emdem c h ne r has at parently not of great virulence. In me ther the Polish nor R as a epsi mics a s the percentage mort lity as high a in the Serbian outbreak. Other outbreaks coursed at the close of the 11 11 ll ar repectally among Greek and Armens a refuse a

Du ing the Ital an campuigns in Abyssinia in succ Castell ni reported that if ere ne at least 10 000 cases of typhus among the thes mun to one but not a single case der loped in the Italian troops becau e of the rigorous clean ness erforced at being except onal to Ind an Itali n soldier who was verminous. There were also he states in the Abyssinian army some 20 000 to 30 000 cases of relate ng fever but only 17 cases were rep ried in the Italian troops

Typhoid feter and typhus fever were only separated chinically as distinct diseases by Gerhard in 1837 Huxham, however had previously noted the marked difference between the 'putrid malignant fever and 'slow nervous fever" Until very recent times it was declared that typhus fever was among the most contagious diseases of man and innum erable instances were cited of frequent contagion of those attending or visiting typhus patients In 1900 Nicolle, in North Africa demonstrated that the disease was transmitted by lice and the experiences in the Balkan war and in the Serbian enidemic of 1915 show that in the absence of such vermin the disease does not appear to be contagious

The late Sir William Osler remarked that the gradual disappearance of the disease in Great Britain and on the continent has been one of the great triumphs of sanitation and this also proved to be the case in con nection with the epidemic in Serbia It will be recalled that the Serbian epidemic of typhus fever was the first extensive and serious one to occur since the demonstration of the method of the transmission of this disease by lice in 1909 to It should be emphasized that the efforts of all of the physicians sanitarians nurses and particularly of the people generally in Serbia being directed against the spread of the disease by pediculi, the suppres son of the epidemic by intensive work was accomplished within a period of six months

Geographical Distribution - Europe has been the principal center of the great typhus endemics of the world. There have been recognized for many years two major endemic foci the Union of Soviet Russia and Poland For many years before the World War and the Russian Revolu tion, there were from 50 000 to 80 000 cases of typhus reported annually in Russia where the hygienic conditions were usually bad and there was overcrowding of jails with political prisoners much poverty many move ments of the population on a large scale and frequent wars. Although numerous endemic foci still persist in this country, through recent public health campaigns the situation has been somewhat improved

The epidemics that occurred in Russia Rumania and Poland after

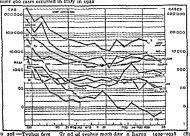
the World War have already been referred to under History After about a decade of steady decline in the prevalence of typhus throughout the

world the disease during the period 1933-40 has shown a notable increase in several countries This new wave apparently reached its peak in 1933 in Egypt and in Chile and in 1934 in South Africa and in most of the countries of easiern Europe In 1934 and 1935 the disease was especially severe in the Soviet Union It al o was prevalent in Rumania Poland Lugoslavia an I lortugal in 1914-35 The disease usually reaches its height in Poland and Rumania in April or May During th years 1935-39 the number of cases did not rise above 700 as a maximum and in the winter months has been below 100 In Rumania since 1935 th disease has greatly decreased from a maximum of 1600 cases in 1936 to below 100 in 1939 However from fan-Sept (1042) 1 400 cases were reported

During 1941-42 the European reports from some areas are not available or reliable as in Russia and Germany In Cermany Jan-June (1947) only 7 or 5 cases and for 1942 only 2732 cases were reported and in Hungary 713 cases. For January April 1943 there were 9 3 cases while in the Union of Soviet Societist Republic only 67 cases for this same period More reliable figures from Span show Jan -June (1941) 4 357 Tophus I as all a appeared recently in sporadic or epid mit for in Isla Minor

Sarra Palestine and all the countries of North Africa Until quite recently Equatorial

Africa vas free from louve borne typhus but in 1932 an outbreak of the di ease occurred in Uganda e pec ally in the sections of the district lying above 5400 feet also appeared in ep demic form in Urundi Uni a of South Africa Busutoland and in the Transvaal Lordem cs also occurred in North Mirca in 1937-38 and in the latter vear in Morocco In North Minea Jan Sept (1942) the follo ing significant figures nere reported Algeria 34 550 Legit 12 350 Morroco 25 580 Tuns 15 850 merease has occurred in 1943 in Fig.pt 40 000 cases being reported An outbreak of some 460 cases occurred in Italy in 1944



Ptg 208 - Typhus feve d m olog: al Intell gence Serv ce of the L gue ! Nat na)

In Ama the affected areas b we been in the northern half of the continent and the disease extends southward to the mountainous parts of Iraa. Afebraistan. British India southern Indo China and southwestern China During 1941-1942 typhus in Central and South America has been especially noted in Bolivia Chile Columbia and Guate mala and to a less extent in Mexico (1941) In Guatemala Jan (194)-June (1942) some 2 000 cases and 477 deaths 1 ere reported Plots (10.12) has shown from serum reactions that this outbreak is apparently of the epidemic type of typhus Patino Camargo has also shown that the outbreak in Bolivia was due to R proversks and Groot (1941) that the epidemic in Columbia also was due to the classical louse borne strain of views.

There has been no ep demic of the classical Eur pean louseborne typhus in the United States in recent years The Ph ! delphia epidemic 1836-7 was of special note since it was in conn ction with it that Gerhard first differentiated the disease from a

clinical standpoint from typhoid fe er

In the rourse of the 19th century se eral epidemics of moderate size occurred in a number of the American scaports and along the Atlantic Coast to the no th of Mexico. which apparently originated among affected I ish immigrants. The last report of ep demie typhus in Ph ladelphia was in 1833 Phopen (938) howe er has reported that endemic typhus has been present there some 27 cases having been recorded a nee 1911 The largest outbreaks in New 3 14 of this nat re were in 1902 and 1803 Since to s date only a few cas s of typhus ha e been detected among mm grants which were held in qu rantine. However the louse borne infection of Alexico Exbardillo has occase nally b en brought no thward men the Unit d States resulting in outbreaks of the disease in Iona (917) reported by Boyd in Cal forms reported by Cumming and Selton and in New Mexico 1982 reported by Armstrong Sporadic cases of mild typhus (known as Brill's dise se) still appe r from t me to time especially in New York City and endemic murine typhus occurs especially in the southern United States

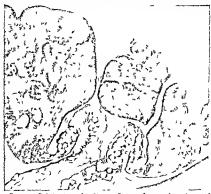
Be gad er Ce rai box (944: has reg sted the control and term nation of this utbreak by th Un ted States of Am r ca Tal hus Comma ssion

932 ETIOLOGY

(These types are dis ussed on p 953) Small numbers of sporadic mild cases of typhus have also been reported by Hone from Adelaide Australia

ELIOTOGA

For many years the true etiology of typhus fever was unknown A number of different bacteria both bacilli and cocci were in earlier years described by a number of investigators as the cause but none of these claims were substantiated. The infectious nature of the disease was



Pir 209 —R kitis sprono dia X 13000 Seri on Junet on of ocophagus and of gut of louse. The spith hall cells of the oce phagus and niceted. The epithel at cell of the multipate restly swellen and havely of et d with telestiane. Nearthele of the membran of the gut on either so of the occophaga it on ream It go outs of bandl forms reference (Pr porsion of Wolb ch. Court sy Har a d. Laivers by Press.)

well recognized but the gross pathological lesions encountered at autopsy, such as enlargement of the spleen with parenchymatous degeneration of the viscera were obviously not characteristic. The discovery of specific histological lesions by Fraenkel in 1914 did not reveal the cause nor did the study of microscopical preparations from viscera and of cultures upon bacteriological media reveal any specific microorganism Later the blood was found to be infective for guinea jugs and monkeys (Ricketts. Nicole Anders) some of these infections were

produced with filtrates of material containing the virus notably by Aicolle and for a time some observers believed that the disease might be classified with those due to the filterable viruses. However Ricketts (1909-to) reported the presence of visible organisms in the blood of man and in the blood of monkeys and guines pigs inoculated with human infected blood as nell as in infected fire that had bitten cases of typhus fever and of ticks that had butten cases of Rocky Mountain Spotted fever Rocha I ima in 1016 also encountered and described rickettsiae in lice which had fed on human cases of typhus. Shortly afterwards other rickettsiae or rickettsia bke organisms a ere found by a number of observers free in the intestines of normal lice, as well as in lice which had bitten patients with other febrile diseases. This led many observers to hesitate regarding the suggestion of the etiological nature of Rickettsia pronuzeks in typhus fever Honever further proof of this fact was given by Wolbach

Wolbach and he associates Todd Palfrey and Pinkerton in a study of Typhus in Poland in 1020-22 found that intracellular Rickettsia prows the occurred only in lice (and in a large percentage of them) after they had been allowed to feed on typhus cases They also found from hi tological studies of ti sues of human beings who had died of typhus the same organism localized almost exclusively in the vascular endotbelium The reaction to the Rickett va was shown primarily by degenerative changes giving the to thrombons in blood vessels and by a proliferative reaction on the part of the endothelium and neuroglia which gave rise to the characteristic microscopic nodules of the disea e in the skin and central nervou system. From these investigations and later contiguatory work the evidence that Ricketting proug els is the etiological factor in typhus fever would appear to be definite

The cultivation of Ricketting is di cussed on p 924

Transmission -- Fridemic typhus fever is transmitted by the louse Pediculus humanus Ricketts (1006) first demon trated the experimental transmission of the rickettsial disease. Rocky Mountain spotted fever by inoculation of the blood into guinea pigs and monkeys. He also showed that it was possible to transmit this disease by infected wood ticks and the following year showed that the virus was transmitted hereditarily in the tick. In 1909 he reported the presence of the microorganism causing the di ease in films of the blood of man and of the monkey and guinea pig and in the tissues of the tick

Nicolle Conte and Conseil (1909) working in Tunis first showed by actual experiment that the chimpanzee could be infected with typhus virus by the injection of a small amount of blood from a human case in the active stages of the disease. They then showed that lower monkeys could be similarly infected by the inoculation of the chirapan ee's blood and that the infection could be transmitted from monkey to monkey by means of the bites of the intected body louse (I ediculus hu nanus yar corporas) This work was shortly afterwards confirmed in the United States b) Ricketts and Wilder (1910) and by Anderson and Coldberger (1912)

Ricketts also demonstrated the transmission of Meuran typhus or tabardile by the louse. He reported the presence of the mixton organs mot the disease in blood films of the patients and of the mestinal contents of infected fixe and showed by tross rummanty experiment: that typhus and Rocky Mountain spotted for er are two district diseases and that the fies and hed bug are not concerned in the transmission of Mesican typhus.

From other experimental work performed first by Goldherger and 4 oddrson at seems clear that Patientin capitis the head louse may also sometimes transmit the disease experimentally. However it is not regarded as an important agent of transmission during epidemics.

It has also been demonstrated that monkeys may he inlected by the incoulation of crushed lice, or with the faeces of infected lice. The causa tive agent Richellia proma cky, does not invade the salivary glands of the louse but 1 discharged during the active feeding in great numbers in its exercis. Probably the infection occurs through the bite puncture becoming soiled with the faeces, or by scratching. Arkwinght and Bacot (1923) reported that the virus may survive in the excreta of infected lice at room temperature for 11 days.

PPIDEMIOLOGY

Formerly typhus fever was regarded as the most contagious of all diseases. We now know that in the absence of the body (and fead louse) the disease is only slightly if at all diangerous to those who come incontact with the patient. At the same time, expenence has shown that it requires the greatest care on the part of those having charge of louse destruction to avoid being, infected while attending to this duty. The same is true of those examining patients with the disease prior to the cradication of the body kie of the ick.

There is no definite evidence that the spatium or other discharges of a patient with epidemic typhus carry the infection. In the study of the prodemiology of typhus cases in Georgia and Alahama. Maxcy could find no evidence that the louse played a part in the transmission of the discase and he suggested that there might be a rai or mouse reservoir of virus from which the disease was transmitted to man. These cases were sporadic and there was no evidence of tomatar infection. Climically the cases were mild typhus and they gave a positive Weil Felir reaction. The seasonal incidence of this small outbreak was in the summer monthsquart the opposite of the Old World typhus which is most prevalent towards the end of winter. We now recognize this form as endemic typhus or fea borne or munine typhus.

The Transmitting Agent—The connection with the epidemiology of epidemic typions a homolegic of the life instruy of the body four. Feel body four. Feel body four. Feel body four. Feel and humans var corpors (Federal at vestrement) is slightly larger than the feel four. Feel humans var copies it is the species concerned in the transmission of Indian and North African relapsing feers and treach feer as well as typhus fever although its broadlest that the head fource on also transmit these infections.

While the head louse lives smoon the hairs of the head and shows its presence chiefly by the appearance of its pear shaped eggs (n ts) pe jecting from the hair shaft the body louse attaches testly to the under guidace of the garments worn next the skin and bolding

is to the undershirt feeds about twice daily on the human boat like hit rely found on the skin. The female body lone is about \$4 meh lon, and about \$1, pinch lond (\$3 mm \times r 5 mm). The antennee are somewhat longer than those of the level louise Depression of food causes death of the adult so 9 days and the newly hatch \$d louise in 4 days.

The lemale under favorable temperature conditions (65 F) begins to oviposit three or four days after reaching maturity and thereafter during her average life of

four or five neeks lays four o five eggs daily

The eggs when on clothing next the body hatch out in 7 to days and become matter in about two weeks. There is no grub stage as with the deas

mature in about two owers: I arre as no group stage as win the tess.

As the eggs are usually deposited in macressible portions of the clothing as in the
seams and since they remain viable there for more than a mouth infested clothing
should be steam treated before being worth.

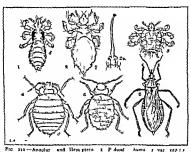


Fig. 310—Anoplus and them press of Palent huma s var capis 2 P fils huma s var capius 2a Protic d to trum of P d ulus 3 Phih us 9 bs 4 Com of til s 5 C e sundstar 6 Tratom megista

An Imp —The body lower is somewhat larger than the brad lower and the r. is keys marked festioning of the wides of the abdomes to but the signests are less will marked. The heal is reparated from the thorax by a narrow neck there bring but shight differentiation between the thorax and abdome. The head is rather olive shaped and more pour od arteriorly where is situated the muth aircrounded by a look bearing mag (the haustlein). The feet's existed and the next that of the the she of the beach of the ship is an existed the new that of the the larger than the situation of the ship is an existence of the ship is a ship

which lead to the oviduct which connects with two ovaries. The eggs receive the cement material in the oviduct

As the body and head lou e differ more in habit or location than in structure and will interbreed readily they are generally regarded as varieties of the same species is Pediculus kimmons varieties capits and corpors

The lice will usually leave the buman host only when he has fever or when he dies but they of course may drop off or be brushed off. They are not apt to be found in the bedding. Those who bathe and change the underclothing frequently do not become louse in the drough there is always the possibility that an occasional louse may gain access to the body and perhaps transmit typhus infection.

Pediculus Humanus var Capitas (Policulus Capitas) —The eggs usually 60 in unufler are deposited on the hairs of the head the favorite region being back of the cars. They hatch out in about studys. The like larva con emergence closely resemble the adult and begin to feed shortly after batching. They moult about every three days and become adults within the days.

The zdulfs vary in color according to the color of the hair of the host. The thorse is as broad as the abomen. The male losses sensifier is required of gosteriord about a dor at apecture for a pointed pent while the fermile is recognized by its larger size a min it length and by a deep notch at the aprec of the last abdomnal septiment. There seems to be a marked preference exhibited by lice for their own poculiar ratial size.

A great many physicians of different nationalities died from typhus during the World War and a great many more contracted the disease In many instances these physicians were thoroughly cognizant of the common method of transference of the disease by lice and of the pre cautions to be taken in avoiding such infection. In a number of instances where particular care was taken to avoid contamination with lice never theless infection with typhus followed. For this reason it has been particularly urged that infection must sometimes occur in man by another manner than through the agency of pediculi and it has been suggested that the droplet method of infection after coughing might sometimes occur in this disease. It is recognized that in the early stages of typhus there are likely to be inflammatory conditions of the mouth nose and As yet honever there has been no experimental proof that the sputum or saliva in typhus fever contains the virus. It has been reported that certain infections in the laboratory have occurred in workers who have acquired the infection from the spraying of emulsions from infected lice into the eye and there is also evidence that infection from louse excreta can enter through slight abrasions of the skin or by inhalation *

Blanc and Baltarard (1938) have reported that infection from typhus can be produced by placing dried flea extreta on mucous membranes and they believe that infection through the mucous membrane may be a frequent method of transmission of murine typhus

They made attempts to infect 6 individuals with dired exercts of infected fless placing 20 milli rains on the usual micross of 2 inventors and 5 milligrams on the conjunctivate of others. Two others vice given the dired exercts dissolved in water to drink. One of the men inoculated by the massal route developed the cr. There was no apparent.

Some 2, such laboratory infections have been reported in individuals that had been thoroughly vaccinated a considerable number of cases of infection by inhalation of inclett are from three louse feces in clothing has a been reported at delous ng stations in Germany duffing 1943.

reaction in the 5 others. However when these 5 were tested 65 days later by the injection of luring virins; were found to be minime. Herefore they thought that at least-40 the 6 men had been infected. They have reported that the direct exercts of infected here of fleas may rite an its variebnes for at least it months and suggest that louise borne lythus infection may also occur by the oral route or by dread louise exercts. Violle (0.35) has also succeeded in infecting animals by feeding them infected material Starrow (10.35) and Mareschal (10.39) have also shown that infection of guinea pigs and of man may occur through the laught mounts in in. mit me, with 1 in mit next.

There is good evidence that the virus of mutine typhus is present in the utine of infected rats and Nicolie (1934) and Lechuston (938) believe that man can be infected through the ingestion of foods so led with rat unner since aimmal may be infected with mutine typhus through the ingestion of material containing, the viru. The transmis

sion of endemic typhus is considered on p oss

Climate.—In epidemic typhus the disease is most frequent in the winter and early spring often diminishing or in some instances disappear ing entirely during the summer. The heavy clothing worn in winter affords the opportunity for breeding of hee while crowding by the people in their houses in winter and in their sleeping quarters facilitates the transmission of line. Warm padded and fur lined clothes and fannish furnish especially favorable breeding facilities for lice which live especially in the clothing and only come to the surface of the body for feeding

PATROLOGY

Frankel in 1914 first called attention to the specific lesions consisting of problerative changes in the endothelum of the arterioles and attental capillaries followed by necrotic changes. These changes are chiefly manifest in the vessels of the skin central nervous system and myocardium. In addition to the proliferation of the endothelial cells there is a pervisacular infiliration of small round cells. Liur Nichol hoted that there was a combination of proliferative and infilammatory changes. The lesions are microscopical and there is a bence of characteristic macroscopic findings. This proliferation of endothelial cells give is rise to small seellings somewhat resembling minute miliary tubercies and the perivascular infiltrations in the hiran may suggest that seen in racephalitis. The perivascular infiltrations in the skin produce Franches I sylbus nodules and the microscopical examination of a small piece of skin may be dagnostic.

The petechnic are due to thrombosis of the smaller vessels and subequent haemorphagic manifestations. These important studies by Fraenkel were confirmed by Aschoff (1915) Chian (1917) Jaffe (1918)

Wolbach (1920) and others

Morbid Anatomy —The gross pathological lesions of typhus are not distinctive. The rish is often evident at post mortern. Haemorrhages of considerable sure may be present in the skin and subcutaneous tissues especially in areas which base been subjected to trauma. Areas of skin necrosis or gangrene may be present. They are rarely accompaned by thrombosis of the large vessels being due to extensive thrombosis of the capillaries of the small veins and arteries of the skin. Small haemorrhages in the conjunctivae are frequent. The beart usually shows slight gross in the conjunctivae are frequent.

938 PATHOLOGY

changes Cloudy anelling is often present. Microscopically the blood vessels show similar leasons to those observed in the skin, and sometimes there is considerable infiltration with mononuclear and polymorphonuclear cells. Phombs are rarely found in the larger blood vessels. In Wol bach's series of 39 cases mural thromboss of the aorta and blars was



Pig 211 —Th skin from a ca e f Mex can typhu showing the prolif rative les one typh a nodule and a cross section of an artery with a thrombus (Pr paration of Wolbach Contest Harvard Unive stup Pr ss)

observed and thrombosis of the mesenter; carotid pulmonary and splenic arteries was also noted as a rare lesion. In many of his cases honever, the microscopic examination of the vessels was necessary to demonstrate the lesions.

The blood is usually dark colored and the liver and kidneys show cloudy swelling. The spleen is somewhat enlarged during the early stages of the disease but tends to be normal in size later on. It is often very soft and then may rupture from being handled at autops. Micro scopically engogement with blood with extressive phagocytosis of red blood corpuscles and diminution of lymphoid elements is commonly present.

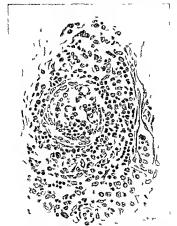


Fig 212—Arteriol of kim Death a se ond we k Sh wag att h d mu l to mb compo d alm t wholly of plagocytic ad th kal ll Petryascul e to m. 400 K (Preparation of Wollds h C unterly flarvard Un vers ty Press)

Bronchuts and bronche-pieumonus are extremely frequent and constitute a most common fast complication. In 8 of Wobbach's series extensive bronche pieumonus was the immediate cause of death. The ocsophigus stomach and intestines are usually normal in appearance. There are no changes in the Pevers patches and the mesentenc glands are not enlarged thus differentiating from typhoid fever. The parotid gland is frequently swollen having become infected secondarily with bacteria from the mouth by way of the ducts. While the serotal tissue may share in the general involvement of the skin in typhus in contrast to the reports of Rocky Mountain spotted fever, the genetalia are affected but slightly. Only an occasional thrombosed vessel is found in the testes with no lessons in the female genetalia.

The leasons in the brain particularly in the basal ganglia medulla and cortex of the cerebrum, and more rarely in the white matter and cere bellum correspond in size to miliary tubercles and are secondary to lesions of the small blood vessels and capillaries, as in the slin. They first consist of a collection of large cells of vascular and perivascular origin endothelium and monotytes with necrosis resulting from occlusion of the vessel. The further accumulation of cells derived in part from the proliferation of mononuclear phagocites and in part from neurogia results in the formation of cell clusters in the nervous tissue. The lesions are invasive in contrast to the perivascular cell accumulations in the brain in most other infectious diseases. The number and wide distribution of these lesions are probably the cause of the severe nervous symptoms which have sometimes been ascribed to the tors of effect on the organism

SYMPTOMATOLOGY

The period of incubation varies from 5 to 15 days. Usually however it is from 8 to 12 days. The period of onset may cover about 2 days during which time the patient bas hradache giddiness backache anorexia perhapi nausea, and general malaise. There may be rigors or chill's aensations. About the end of the second day the temperature rises fairly rapidly to become 103° or 104°F by the third or fourth day With the rise of fever the face becomes fushed the type sinjected and the expression apathetic. The headache is usually quite severe and may be frontal occupital or generalized. The temperature remains elevated with slight morning remissions for from 12 to 14 days when it may fall by criss or more gradually by rapid lysis.

Well marked prostration and cardiac weakness are early noted. There is a tendency to constitution and the mouth becomes foul and the teeth rapidly covered with sorder unless the greatest precautions in oral cleanline's are observed. There is marked tendency to clouding of the consciousness. At times the disease shows an abrupt onset rather than that described above.

The cruption appears from the third to seventh day. Usually it is present by the fifth day consisting of slightly elevated rose spots which at first disappear on pressure but quickly tend to become permanent and later purpoint. The cruption first appears in the avillae flanks and then extends to the abdomen chest and later to the evidence that is sometimes used to describe the rash of 15 phus. In addition to the above there is a subcutricular muttling. The conjunctivae are injected. Along with the appearance of the rash the symptoms become aggravated the effect on the heart is more marked and the pulse.

becomes feeble. The face is often dusky. There may be a bronchial catarrh with an annoying cough

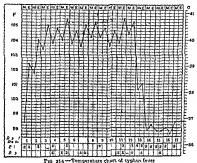
By the end of the first week the delimous or stuporous condition becomes more marked with a tendency to mattering deliming termors and subsultus the coma vigil of the older writers. Terrifying hallucinations may cause the patient to jump from the window and 5.11 mixelf. There is a tendency to patiotis and othis media connected with the mouth condition. On account of the circulatory weakness there is a tendency to gangrene of the extremities especially the toes marely the fingers.



Fig. 213 -- Eryth matous and pet ch. I erupt on Se ond we k. (typhu (P. p. ration of Wolb. h. C. urt. y Harvard University Pr. 21.)

In cases which recover there is a critical change in the apparently desperate condition of the patient about the end of the second week the sudden striking change for the better being more marked in typhus fever than in any other disease. The temperature fails and there is abundant sneating. The stopor disappears consciousness returns and the patient frequently realizes the improvement in his condition. At this time the time changes from a high-colored often albuminous one to an abundant secretion of more or less normal character. General weakness however with persistent circulatory disturbances may continue in some instances for a fortingth after the criss. In other cases in spite of the fall in the temperature, the mental condution remains unfavorable or becomes worse changing from delimin to come.

incontinence of urine and faces, the case terminating fatally. In such instances the symptoms are probably due to the prevalence of wide distribution of the typhus lessons in the central nervous system.



324 -- Lembergente Cities at chierate

SYMPTOMS I I DETAIL

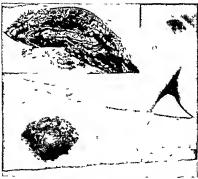
The Eruphon —This first appears about the fourth day as macules about anillae and loins then spreading over abdomen chest and back it is often more pronounced on the back than elsewhere. It almost never appears on the face but may occur on the palms and sole. It has a resemblance to the rash of meaders. At first disappearing on pressure it soon becomes permanent and then petechal. The hind color of the rash has brought about the designation mulberry rash. The rash lasts from a few days to two verks. Markedly haemorrhage rashes may be accompanied by haematitura beemstemens and melana. In such cases, the mental symptoms are frequently severe and the cases are apt to be fatal.

The Fever — The fever rise following a chill is much more rapid than in typhoid fever reaching its fastigum in about 3 days. A more of learn continuous range of fever (20, 20 rog 2, 10 follows until about the four teenth day, when there is often a rap d has or possibly or is at which time the patient tends to fall into a refree bing sleep and to show a rather marked duries.

The Alimentary Tract.—Constitution is usually noted Very marked is the tendency of the mouth and tongue to become dry and sordes to

collect on the teeth The dry black tongue has led to the designation parrot tongue It is often difficult to get the patient to protrude his tongue when told to do so

The Circulatory System—Ver, outspoken is cardiac weakness due to myocardial degeneration. The heart sounds are very weak and the pulse feeble rapid and irregular. The blood pressure often is very low especially the disatolic and may remain so throughout the disease Brady cardia may be marked during convalescence.



Pic sty -h r softh k n and ubcut uf to erght trochanter and lift ondyle of the f mu line t show c s on m d after de th th ugh the let n e the trochanter (Courtey H ward U rsty Pre)

The Respiratory System —Cough may appear in the first days but usually is first troublesome about the time of the cruption By the end of a week, the cough becomes loose and rales of various types may be noted Death often occurs from a terminal hroncho pneumonia

The Nervous System—Clouding of the consciousness may be as marked in this disease as in plague Dull aching frontal headache is common and is an early perdominating symptom. It frequently dimin ishes before the cruption appears. A dull stuporous state soon comes on Delinium is marked in some cases. Yain plague there are often the faces and mental state of alcoholic intoneation. There may be ingulty and

944 DIAGNOSIS

retraction of the neck, suggesting cerebrospinal fever. However, there is usually only a slight increase of mononuclear cells in the spinal fluid, and the fluid is not markedly turbid.

The Blood —There is nothing very characteristic in the blood examination. The leucocyte count sometimes falls in the first day or two, then gradually rises until the crisis, and then again falls. The leucocytosis only moderate it rarely exceeds 12 000 and the polymorphonuclear cells make up about 80-85 per cent. Eosinophiles are decreased. Some observers have noted an increase in the large mononcideras.*

Complications -A bronchitis is very common and later on there may be such a profuse expectoration that it 1 difficult for the patient to expel it and he may become evanotic Bronchopneumonia is a very frequent cause of death Otitis media and parotitis are not infrequent complications Deafness is often marked Retention of urine is not uncommon Incontinence may occur during the delirium Febrile albuminuria and cylindruria are usually present, but nephritis is rare Thrombosis of various vessels both abdominal and peripheral, may be noted Gangrene of the extremities especially the toes, is frequently Gangrene of areas subjected to pressure as over the sacrum is not infrequent Symmetrical gangrene of the extremities was observed by Shattuck in the Serbian cases There does not seem to be the same tendency to gangrene of the genitalia as in spotted fever of the Rocky Mountains Shattuck found that during convalescence suppurative lesions such as abscesses were not uncommon. One patient developed suppurative lesions about the knee joint followed by an abscess near the thyroid A perinephritic abscess was a late sequel in one case. Small boils were common and suppurative ofitis media and mastoiditis were observed not infrequently He found that even after the most severe symptoms convalescence was rapid considering the emaciation and weakness of the patient I ain, more or less severe in the legs and feet was a very common symptom of convalescence. In a few cases rapidity or irregularity of the pulse persisted for a considerable time

DIAGNOSIS

Differential Diagnosis—The disease must be distinguished from typolo fever malaria relapsing fever, and Rocky Mountain spotted fever Prior to the appearance of the rash a differential diagnosis is frequently impossible. However, during an epidemic the diagnosis is often fairly evident from the onset of the fever chill and headache. The more gradual course of the fever and the less marked stupiorous condition together with a positive Widal reaction and positive blood culture should differentiate typhoid fever from typhus.

Plague has the same picture of alcoholic intoxication as typhus but the characteristic rash is not present Influenza, with its acute onset is

confusing but there is not any increase to the number of leucocytes. In encephalitis lethargica there is on eruption and no splenic enlarge.

and the onset is gradual with only moderate fever

Samper has found that when the skin rash has persisted for a considerable period
it might be connected with thrombopenia. In one case the blood platelets were only

It magnitudes to the control of the

Relapsing fever and malaria are satisfactorily differentiated by the blood examination. In both also the spleen is more apt to be enlarged

The distinction between endemic typhus and spotted fever may be difficult on clinical and epidemiological evidence. The clinical course however is generally more severe in spotted fever and in epidemic typhus than in endemic typhus.

In Rocky, Mountan spotted fever a history of tick bite may be of assistance and sometimes a small ulcer may indicate the site of the hite Pinkerton (1940) points out that the differentiation may be made in the laboratory by cross immunity tests in the inoculation of guinea pigs and by the fact that typhus nickatiane grow voluminously in the cyto plasm in the cells of tissue cultures but never invade the nuclei while spotted feer rocketisae regardless of how atypical the strain from which they are derived may be grows sparcely in the cytoplasm but form compact spherical colonies in the nuclei of the infected cells. These distinctive patterns are also found in the cells of infected arthropod hosts the tok and the louse of these two viruses.

The differentiation between epidemic or European and endemic or murne typhus may be made on the hasis of lack of an obvious scrotal reaction with the European strain on guinea pig moculation and from the fact that murine typhus causes a febried disease in the rat with Rickettisase in the scrotal sac while the European typhus virus causes an

entirely inapparent infection in this animal Heil Felix Reaction -In the diagnosis of typhus fever great importance is attached to the Weil Felix agglutination reaction which the serum of typhus patients has noon certain proteus bacillus cultures designated as OX2 and OX19 These correspond in characteristics to certain strains of Proleus rulgaris producing indol in peptone solution and acid and gas in glucose maltose and saccharose but not in lactose or mannite They digest gelatine and blood serum somewhat more slowly than typical cultures of Proteus vulgaris Although these organisms have been iso lated from the urine of several typhus cases it seems certain that these Y bacilli are neither causative organisms nor secondary invaders. The reaction is therefore heterologous and not specific. The reaction appears during the first week of the disease but becomes quite marked in the second week and during convalescence. Thus a titer of r to 25 on the fifth day usually rises to 1 to 200 or higher by the end of the second week The test is made either with living or dead cultures and is carned out as for typhoid agglutinations preferably by the macroscopic method

The first Felix Agg it show Test—The Protons culture recommended by Wesl and Felix and unwessily used as one soluted as up to from the unuse of a typhic case and known as Proton in the Aggs and the Aggs and the Aggs and the Aggs and the west recognized as the figuration type (II) and a non motile unflagalisted type (O) it is this latter type of Protons O'va) that is the stand of culture. Other Protons Strains used for anglemization tests are O'va and O'va. It is strange that the gunner pil infected with Rickettian fails to show serum agglutin on alth uph protected from window of the Control of the Aggle Control of the Control of retraction of the neck, suggesting cerebrospinal fever. However, there is usually only a slight increase of mononuclear cells in the spinal fluid and the fluid is not markedly tribid.

The Blood —There is nothing very characteristic in the blood exam instand The leucocyte count sometimes falls in the first day or two, then gradually rises until the eri is and then again falls. The feucocytosis is only moderate it rarely exceeds 12 000 and the polymorphonuclear cells make up about 80-85 per cent. Eosinophiles are decreased. Some observers have noted an increase in the large mononcideas.*

Complications -A bronchitis is very common and later on there may be such a profuse expectoration that it is difficult for the patient to expel it and he may become cyanotic Bronchonneumonia is a very frequent cause of death. Othis media and parotitis are not infrequent complications Deafness is often marked Retention of urine is not uncommon Incontinence may occur during the delirium Febrile albuminum and cylindrum are usually present, but nephrits is rare Thrombosis of various vessels both abdominal and peripheral, may be noted Gangrene of the extremities especially the toes is frequently Gangrene of areas subjected to pressure as over the sacrum 18 not infrequent Symmetrical gangrene of the extremities was observed by Shattuck in the Serbian cases There does not seem to be the same tendency to gangrene of the genetalia as in spotted fever of the Rocky Mountains Shattuck found that during convale cence suppurative lesions such as abscesses were not uncommon. One patient developed suppurative lesions about the knee joint, followed by an abscess near the thyroid A perinephritic abscess was a late sequel in one case. Small boils were common and suppurative otitis media and mastoiditis were observed not infrequently. He found that even after the most severe symptoms convalescence was rapid con idening the emaciation and weakness of the patient Pain more or less severe in the legs and feet was a very common symptom of convalescence. In a few cases rapidity or pregularity of the pulse persisted for a considerable time

DIACNOSIS

Differential Diagnosis —The disease must be distinguished from typhoid fever, roularia relapsing fever and Rockly Mountain spotted fever. Froir to the appearance of the rask a differential disagnosis is frequently impossible. However during an epidemic the diagnosis is often larrly evident from the onset of the fever chill and heridache. The more gradual course of the fever and the less marked stupiorous condition together with a positive Widal reaction and positive blood culture should differentiate typhoid fever from typhus.

Plague has the same picture of alcoholic intoxication as typhus but the characteristic rash is not present. Influenza with its acute onset is confusing but there is not any increase in the number of leucocy tes

In encephalitis lethargica there is no eruption and no splenic enlarge ment and the onset is gradual with only moderate fever

Snapper has found that when the skin rish ha persisted for a cound rish penni it might be rometted with thrombopenua. In one case the blood platelets were only go per per in (Charries Lessons to Western Wedence 1941) Lampert who has studied goo cases in dualy observances of it blood found during the first less darker was a promounced shift to the left in the 'unter-Beshilm guide.' It concluded that at this stag when the percentage of the neutrophiles with rod-shaped nuclei (Libb) was 2-pc. bits navi diagon in ted Typhus.

PROGNOSIS 947

The mortality in enidemic typhus is greatly influenced and increased by lack of proper nourishment and nursing and care given the patients The mortality usually increases with age In children it is a very mild disease and death rarely occurs in individuals under 20 years of age except in severe general epidemics. In later life the hability to severe broncho pneumonia which results fatally is more common Old people are gener ally apt to succumb

The prognosis is serious in cases with high fever profuse rash and

marked mental disturbances

Typhus fever has claimed more victims in the medical profession than any other epidemic disease. The mortality among physicians in epidemics is generally high. Osler states that in a period of 25 years in Ireland among 1230 physicians attached to institutions 550 died of typhus Minkine reports that out of 13 physicians working at the typhus hospitals 12 contracted the disease and 6 of them died Butler in connection with his typhus hospital unit states that of 6 physicians 4 contracted it and a died. The mortality among the Serbian physicians in 1915 amounted to 126 out of 350 or 36 per cent Moreover some of these physicians were regarded as immune from previous attacks contracted before this epidemic. Friedberger in reporting an epidemic at Schutzen in 1915 states that 4 of the doctors were attacked and 14 died a mortality of 58 per cent that of 332 nurses 71 fell ill of whom 15 died a mortality of 21 per cent at the same time the disease among the Russian prisoners showed only a mortality of 7 8 per cent Why the infection with typhus has been so common and the mortality so bigb among physicians is not explained. There is no evidence that there is opportunity of direct infection by some means in which the virulence of the infection (as in pneumonic plague) is uniformly greater than when it is transmitted through the intermediate host-in the case of typhus the louse and in bubonic plague the flea. However infection through the conjunctive is possible and it has been demonstrated by Durand and Giroud that it is possible to infect mice by the intrapasal installation of the virus of epidemic typhus (See also p 036)

Immunity -It has generally been regarded that an immunity usually complete follows recovery from an attack of typhus Such immunity may last for a long time However that the immunity is not permanent seems evident as a number of well authenticated instances of second

attacks and even of third attacks have been recorded

Zinsser and Batchelder found that the serum of convalescent guinea pigs contains protective bodies which protect other guinea pigs from infection with typhus virus provided the serum is collected from the first to the fourteenth day after defervescence Serum taken later than the 21st day no longer protected. Also in human beings apparently protective bodies are not present in the blood after about three weeks Zinsser (1940) suggests therefore that true immunity in typhus depends upon tissue resistance rather than upon circulating antibodies. With tissue cultures of rickettsiae he has shown that convalescent sera may 946 BIAGNOSIS

The test should be performed macroscopically Serum dilutions of 1 to 23 and even to 30 may halt to against the foreign throad zone) whereas higher dilutions (1 to 100 or 1 to 30 or). The foreign this show the threat the foreign are demonstrable by the end of first week and the titer rises during the course of the disease often reaching to 2000 at the termination of the fever after which it ready falls. A titer of 1 to 80 or less has no significan e 1 to 100 is suggestive 1 to 330 or 1 to 640 is usually but not invariably distribute. Titers as high as 1 to 400 on how been renormed.

The Journal of the R.A. V.C. in an editorial (March. 1935) states that a classification of inchettsiae according to their vectors is unsatisfactory and advocates a classification based on artige c relations. The following table based on the work of Felix is given

	I pidemic typhus	Tsutsugamushi	Rocky Mountain spotted fever		
Vrg .	+++		1 +		
λ2	+	-	+		
\P			1 :		

Bridges (1935) has noted that white the O wantry of X2 is extremely stable this a not the case with these variants of N2 paid N\x hoch hold not change to II warrant. He points out the difficulties of maintaining standard cultures even in great national laboratories and emphasizes the advantages of killed superaisons over the luving organisms. Endges recommends killing with alcohol their removing the all-ohol and resuspending in asline then preserving with buffered formol saline with the concentration of the

formalin o 25 per cent

Although I six has reported the cultivation of Protess \text{ from the blood and organis in typins there is hitle evidence either from yistenetic blood and urine cultives performed during hie or from the organs post mortem that this bacillus is the chological factor in typins. For a time the hypothesis was su geated by some that rickettsiae reprient mutants of B p stems. This were however is no longer regarded as correct Anagistin in his attempts at cultivation of rickett are obtained certain appearance of growth which hed him to believe that a close connection cast fed between rickettsian Bacillus riskoffens. This view is also no lonest held tenable. However no satisfactory explanation of the significance of this reaction in typhus fewer is known The only suggestion of its explanation has been furnated by Junser. Castaneds and Zia who have found a common antigenic factor probably a carbohydrate in protess Oxiga and in suppensions of thempte ricketts.

The "attornal Institute of Health and Piotz in the Army Medicial School Washing too regard a rise in titter of greater psymbence than any 1 reading subject at 18 above 1850. A slide aggitationation test has all o been suggested with Protous and allow with a nacketishal autiem. Van Poos and Bearcrief (1954) in the aggitationation test in the British Aiddle's Law forces in Pryst have u ed necketisma suspensions) prograted by Concentrated necketisma exception of the Concentrated necketisma waveness constitute a satisfactor, natione either for use in the

complement fixation or agglutination test

Com lement Justian — Early loying special, refettinal antigenes correlement fination tests can now be performed to distinguish between the various racketisal disease a Castaneda and Bengton and Topping have rejorted such a test for endemic typhus Bengton for Q fever and Plotz and Westman for Rocky Bountam spotted fever Plotz has recently developed an epidemic in kett 11 antique so that postive fination is obtained in experiment by the production of the produ

PROGNOSIS

The mortality has varied greatly. In different epidemics from as low as 5 or 10 per cent to 70 per cent. A mortality of 20 to 35 per cent is not uncommon During the Serbain epidemic (1915) it reached 70 per cent, but in other more recent outbreaks in eastern Europe it last been as low as from 8 to 12 per cent in more of these the virus may have been that of endemic mutine typhus. In endemic typhus of the United States the mortality is estimated by Maxry to be between 2 and 4 p

of the patient. Cardiac stimulants are often indicated as caffein and camphor or tincture of digitalis. Caffein in 0 = 0 = 0 grim doses is some times recommended in the cases which collapse. Thyroid extract has been of value. Shattuck, in cases with collapse symptoms found that salt solution administered intravenously to patients in which circulatory disturbances seemed to be mainly due to vascular relaxation responded satisfactorily. When patients are rapidly losing strength because they cannot assimilate food he advocates the use of alcohol not in small doses but freely. Lumbar puncture for the relief of the delirum and other cerebral symptoms has sometimes been of benefit. Codein is indicated when the cough is troublesome

Menk (1944) reports that sulfapyridine has been used in the treatment of typhus in Warsaw ance early 91 especially in relation to the complications of which the most common and dangerous is pneumonia due to secondary bacterial invasion. The impression has been gained that the drug trinds to prevent pneumonia but there is no

evidence that the sulfonamides influence the typhus disease itself

On different occasion. The serium of con alexcents from typhus has been employed by many workers for the treatment of the disease. Dursand (1932). Elman (1934) and others reported some beneficial results. However Levaditi and Lepine (1938) he clough that if an during the course of the Miness is distilled rests the evolution of the country of the course of the Miness is distilled rests the evolution might mit at the severity of the a proton it did not shorten the course of the disease. Of the other charges have very lawer recommended serium for pressive immunication.

N coile and others have emm nded fo teatment the sers of hore so or as es intravenou is no ted with me gd s s in first dissue. However the major is of clinicas have shand ned the ue it such s a 60 teatment. More recently Z as an GC statement Ance prepared as ant me els s seem who the high propriate to the statement of the state

Preventive Measures—During an epidemic of European typhus a plan of campaign should be made and should include general distinctisation of people in badly infected districts; general house to house inspection in such districts with removal of patients to hospitals for typhus cases disinfectation of other immates of such houses disinfection or disinfectation to houses from which patients were taken or in which deaths from typhus had occurred the establishment of quarantine and bathing and disinfesting stations at unportant points throughout the country the limitation of railway travel by reducing the number of passenger trans and the establishment of a system of limited travel permits and of inspection of travelers only cars with wooden seats with no upholstery being permitted to be run provision for the cleaning and disinfecting of such cars after each journey provision for the cleaning and disinfecting of such cars after each journey provision for the cleaning and disinfecting of such

Van M. end k (1942) h reported that one tabl to f subme hydrochio de (10.2 g.m.) to dispethe with a day in spect in f [0.0 occ of a 0.0 per cent solution of calcium gluco ateo a no pere t is butson of calcium gluco ateo a no pere t is butson of calcium gluco ateo. A specific treatment for typhis I we II nevere use as much as a oce of selection thombed has prived tryphis of the complexity of the control of th

948 TREATMENT

develop active rickettisal agglutnins which are diagnostically reliable Using murine organisms washed out of the pertioneal cavities of x rayed rats and the Weigl louse vaccines (of epidemic typhiss), he showed that there were cross reactions between these two organisms which indicated that they were not identical but closely related. It has also been demon strated that phagocytosis enhancing properties (opsonins) also may develop in convalescent typhus serums and may persist longer than other immune bodies.

Epstein using emulsions of infected lice, human convalescent serum and citrated blood showed that neketisiae may be actively taken up

by the leucocytes

Castenada (1936) demonstrated that opsonic substances may remain in the serum of convalescent guinea pigs for as long as 3 months after infection. It is the acquired immunity of convalescence and the immune substances which have developed during convalescence and in inoculated animals that have encouraged the bope that methods for active immunization against the disease much the devised.

TREATMENT AND PROPHYLAXIS

Treatment—There is no specific treatment and there is no disease in which careful nursing is so important. Shattuch, from his experience in the Serbian epidemic emphasizes that it is certain that fifth, famine overcrowding and lack of ventilation favor the spread of typhus. They lavor it not only by increasing opportunity for transmission of infection, but also by weakening in advance the resistance of the person infected it seems certain that bad conditions of bring tend to lower the resistance of the individual and to increase morbidity as well as mortality in an epidemic of typhus

The first fundamental principle of treatment rests on these facts It demands maintenance of the patients remaining strength by every possible means (1) by removal from unsanitary surroundings (2) by

good nursing and (3) by a well regulated diet

It is very necessary to maintain the recumbent position. Continuous rest in bed with abundant nourishment are important to the strength of the patient. An abundance of water should be given and the diet should consist of milk broths and soft solids. The tendency to skin earnering requires constant watching.

The care of the mouth is very important. A mouth wish of equal parts of borne and solution glyrerine and lemon june should be used to swab out the mouth several times daily. Constitution should be controlled by enemata. It is best to give the patient abundance of firesh are so that tent treatment with appropriate chinatic environment is to be recommended. Cool ponging lessens the nervous manifestations as well as lowers the temperature. Ice bags to the head are advisable for the relief of headache. Veronal or chloral may be needed to control the insomma and hyoscine in cases with acute delirium with or without morphia is of advantage in giving rest and in conserving the strength

of the patient. Cardine stimulants are often indicated as caffein and camphor or incuture of digitals. Caffeine in 0.2-0 g gm does is some times recommended in the cases which collapse. Thy roid extract has been of value. Shattuck in cases with collapse symptoms found that salt solution administered intravenously to patients in which circulatory disturbances seemed to be mainly due to vascular relaxation responded satisfactorily. When patients are rapidly losing strength because they cannot assimilate food he advocates the use of alcohol not in small doses but freely. Lumbar puncture for the relief of the delirium and other circibral symptoms has sometimes been of benefit. Codein is indicated when the cought is troublesome.

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Notile a dothers have recomme ded for treatment the sea of horses o a est intravenously impacted thincress glosues districted usues. Ho ever the majority of clin cams have aha doned the u of uch sea for treatment. More recently desired as the season of the season specific protect e prophylactic and the peutic acts of or guiness page. Zealist (2019) goods that hat serverum is not been extensively us did Nicino Tunn. Date of the season of the seaso

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Van Me rend nk (943) has reported that ne tabl t of atab e hydrochloride (or gram) t of t gether with a d hy nigerion f o-no cc of a no per cent solut no factour nightcoards or a oper crast such no factour nightcoards or a oper crast such no factour nightcoards or a oper crast such no factour size no percent categories that the fore typical services of the such se

public vehicles particularly of cabs at the railway stations the sanitary inspection of restaurants and cafes and the establishment of regular hours of closing during the day for cleaning and disinfection, and the methods to be employed for such disinfection, regulations for hospitals in connection with the disinfectation of the wards bedding and lines, and of the inmates and their clothing, the establishment of free dispensaries in various cities, not only for the treatment of the sick but for the early detection of individuals suffering, with infectious disease, a carriaging of education with printing and distribution of circulars regarding the nature of the disease the manner of its spread and the precautions to be taken to avoid infection. The details of such work obviously cannot be discussed in a textbook

Per onal prophylavas consists especially of the destruction of body lice, or preventing their access to the period. Those attending cases should wear gowns closely fitted at neck and wrists and rubber gloves. Better than a gown are unionalls with stocking extremities to go under over the shoes. The typhus case should be deloused with the greatest

thoroughness and his clothing sterilized

For ridding the body of lice the following stens are essential

The hair of the body and head should be elipped

The subject abound be bathed there being used freely kerosene emulsion soop prepared by bothing a part of soap to 4 parts of water and then adding parts of kerosene of. The resultant jell, when mixed with 4 parts of water makes a liquid soap that is convenient to use and which may be applied effectively.

3 Following the bath the body may be anointed with kerosene special care being devoted to the hairy parts. Skin irritation may, how

ever require early removal of the oil

4. It has been found that hee on clothing removed from the body may remain alive nine days and their eggs as long as forty days. The clothing therefore should be disinfected by one of the following methods

(a) Steam (b) boiling for five minutes () 5 per cent compound cresol solution for 30 minutes (d) chemicals such as evalude or chloropterin

g In the absence of facilities for carrying out the steps described, or to prevent infestation subsequently dusting powders are sometimes used Of the c the N C I powder containing commercial nighthalene 96 gms, crossest, 2 cc and nodoform 2 gms is the most widely known but Moort > powder—cressots : ct subplay to 5 gms and tall o gms—is less printiting and is said to be ask times as effective. It has also been recommended to wring out the underclothes its 5 per cent compound cross solution then drying thoroughly or to impregnate them with substances such as the hologenated phenois. A temperature of 55 to 65°C for 75 mnutles is sufficient to kill lice and the blankets and woolen clothing may be treated in the tumbler of the laundry and thus made I is free

Recent studies carried out by the United States Army and reported in Crular 50 Office of the Sur_kon General November 1942, indicate that the best delousing of clothing and equipment can be obtained by the

use of QM issue methyl bromude either in portable and demountable forced air circulation, gas chambers made of plywood or in special QM issue bags made impervious by impregnation with ethyl cellulose Clothing and equipment are not impured by this method. The furnigant methyl bromude is slightly more toxic than carbon tetrachloride but when used in the prescribed manner it can be safely handled and gas masks are not required by the personnel mivolved. The gas has great powers of penetration and when the proper dosage is used it will in 30 minutes destroy all insects or insect eggs even if they are on clothing in the center of a filled barracks bag. Clothing furnigated in this way can be safely resisted to the owners within one hour or by the time the concurrent body delousing and bathing procedures have been finished.

The approved QM issue insectucidal powder may be dusted into the seams of clothing every 7 to ro days not only as a delousing measure but as a prophylactic against infestation. The delousing of the body sur faces scarred out by barbering and by the local application of insecticides followed by careful bathing and the combing out of any retained nits. The amplication of insecticides should be done for immutes more to bathing

by wetting the hair and skin with the following lotion

		Per Cent
Pyrethrins		0 25
IV 930		2 0
Ca tor oil		20
Isopropy! alcohol		Br o
Water q s	ađ	0 00

Another satisfactory method of destroying head or crab lice is to apply to the hair and skin areas involved one of the following insecticides 24 to 48 hours prior to delousing of clothing and bathing

Lethane 384 special 50 per cent in mineral oil
Lauryl thiocyanate 25 per cent in mineral oil
OM issue insecticidal powder

Apply 8 cc of either of the above liquids to the hair and skin areas involved or dust heavly with the insecticidal powder and rub in Dimethyl phthalate both as a repellent and insecticide has been found to be especially effective while D D T (or Gesarol) is said to be most effective in the destruction of hie and their ow a Underwear impregnated with 1 per cent emulsion remains louse free for a number of weeks and often after several washing, 6sep 1747)

In the absence of these special preparations the hair should be shaved or close clipped Vinegar or 15 per cent acetic acid may be rubbed into the hairy surfaces to losen eggs, followed by vigorous shampoo with bot soap, water containing 25 per cent Aerosene and removal of any remaining

nits by combing with a fine comb

Precautions should be taken against droplet infection as in pneu

monia and the possibility of infection occurring experimentally through the mucous membranes of the eye and nose should be borne in mind Pickettsiae may be blown into the air in the form of dust from dired louse excreta and infection occur through inhalation especially in handling louse infected dothing. Furnigation and insecticides as lethane do not destroy neckettsiae.

950 PROPHYLAXIS

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Castor oil		2 0
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mona and the possibility of infection occurring experimentally through the mucous membranes of the eye and nose should be borne in mind Pickettsate may be blown into the air in the form of dust from dired louse excreta and infection occur through inhalation especially in handling louse infected clothing. Furnigation and insecticides as lethane do not destroy neckettsate.



Hypodermic needles used on typhus patients should be immediately carefully sterilized and any wounds about typhus patients should be carefully cautenized

Protective Inoculation -The field of protective inoculation against typhus is still in the experimental stage. The following methods have been particularly proposed. First the inoculation of defibrinated typhus blood heated to 60 C for one hour Inoculations of this rature were made in the Turkish Army in 1915 but the results were not convincing They were repeated on German troops in 1916 with negative results Later Nicolle suggested active immunization by the injection of small amounts of virulent typhus blood or typhus guinea nig serum method was not without danger and has been discontinued. Bland has especially advocated and used a hyme attenuated vaccine made by submitting to the action of or gall the organs of guinea pigs infected with munne typhus Blanc a vaccine has been used very extensively and Gaud reports that more than a million people have been vaccinated in Morocco and that it has given excellent results. In Chile however the results appear to have been le a satisfactory where among 800 vaccinated 23 per cent were said to have showed a picture of grave typhu and s died The virus was isolated by animal inoculation from the blood of patients with vaccinial typhus by Palacios Laurens Fort and Bernier (1939) have reported failures in military practice from the use of this vaccine (murine living typhus virus) which they attribute to the impossibility of keeping the virulence of the vaccine constant and to its rapid loss of efficacy Laigret has also employed an attenuated living murine virus by drying the infected brain tissues It is reported that over 3 000 per sons bave been vaccinated with this murine vaccine and that there were no serious accidents. However Laignet (1027) reports that sicalles showed symptoms of murine typhus from 10 to 16 days after vaccinations reports however that authentic cases of typhus in those vaccinated have 53 far not only been very rare but have never been fatal

Tinsset (1949) pointed out that immunization with living virus as recommended by Laigret and Blanc is inadvisable owing to the dangers on the one hand to the individual vaccinated and on the other to the

community with the possil they of bringing about an epidemic

Killed Yurus—Spen.er and Larker (1925) fir t demonstrated that immunity might be obtained in Rocky Mountain spotted fever by the use of the killed writs. Their prophylactic was prepared with suspensions of the viscers of infected tacks ground in a mortar and killed with o 5 per cent phenol. A single tack sometimes contained as much as 1000 infect tous doses. With this vaccine guinea pige and monleyes can be protected against subsequent infection. (See Rocky Mountain spotted fever 9 (9.0).

Weigl conceived the idea of preparing a prophylactic against the epidemic typhus wrive by infecting like with the rickettiane through the rectum. The like so injected died between the 9th and 12th days when the cells hining the intestinal tract were found filled with rickettsiae.

The prophylactic was then made from carbolized suspensions of the infected intestines of the hee. The preparation of the vaccine is laborous and the inoculated lice must be fed for over a week on immune individuals before they yield an adequate harvest of incluties. The immunization of a single individual may require material obtained from 50 to 100 kee. For this reason the method cannot be employed for prophylaxis on a large scale. Weigl's statistics in Poland on its use are not convincing However, Rutten (1936) has employed the louse vaccine in protection of missionaries in Central China and behieves that they have dimunished morbidity and eliminated morbidity and have rendered the cases in which typhus subsequently occurred midler and of shorter duration.

Zone et and his a sociates first prepared a prophylactic hy injecting mutine stress intrapentioneally into rate that had previously been irrad ated with a tayle. By this manner force suspensions of reletables could be abstanced from the pertonnel causics and when such suspensions were forminated it is as found that gained piece could be completely protected by them. Case (1922) monitated 22 is objusters with this prophylactic and subsequently inoculated them with infectious material. Only 30 the six developed typical typics as did 40 of the 3 non-vartimated controls. Other results of

value have been reported from Merico

Since the murine vaccine however neverts only portially against the classical endering European infection. It is not possible to perpare a satisfactory prophylactor prophylactor prophylactor prophylactor prophylactor prophylactor prophylactor prophylactor produced by the property of th

Cox (1938) has a o prepared a prophylactic by moculation of fertile hens eggs and injecting the trus directly into the yofk sac the virus being subsequently killed with planning the property of the property of the culti-

vation of rickettsiae in large amounts

The method finally employed by Zinsser Plote and Fuders to secure large numbers of necketisase consisted in a combination of the agar method—using considerably enlarged as Jaces for cultivastion—and the egg technique as a source of incutation. Shee fically the immede embry on e tissue or macerated 30 its set taken from eggs on the Jourth day, following infection is used to moculae e large quant ties of normal minered in, its insure from to day, embryos. The it time thus safected as distributed in large amounts on the ages surfaces of mod feel holle flashs. After 6 or 7 days incubation at amounts on the ages surfaces of mod feel holle flashs. After 6 or 7 days incubation at considerable quantitie of tissues may be employed. I Transplants can then be made by using the culture rickett are or ne cultures inaugurated with material from infected eggs. None of these exactions have been intellad circuity was a papeline of tryphus fever

"However the annual report of the Naternational Health Division of The Rockeleller Foundation reports that Five physiciants into that precived moneilations particularly of the yolk sac vaccine all latter contracted the clusters eithering the interference and Fifteen cause of laboratory infection after protective moneilation, with Wingl's vaccine have occurred at the German Midstay Institute Cenzow." Inther improvements in the preparation and content restorated for the protective moneilation of the report of the content of the

A stimulating dose of x c c should be admint tered every 4 to 6 months as long as senous danger of infect n exists. Additional injections may be given whenever in the outpion of the Surgeon they is deemed advisable.

A German ren rt by Ding (20.22) states that er ups of persons (pri opers or other individual not stated) were inoculated the e o other of six vaccines () louse gut vaccine (We gl) () C vacc ne made at Aoch Institute Berlin (3) and (4) weaker preparations of egg volk vaccine made at Marburg and containin murine as well as ep de n c rickettsiae (5) rabbit hin, vaccine made in Par's (G oud) (6) dog hing vaccine from Rumania (Combiescu) There e e also t o control groups who received o va cine All grouns vere then moculated the typhus rickett tag six to c ght weeks after they had been vacc ated. The weake on vaccine were said to be less effective than the othe s but e sentially there was no difference between the esults obtained with the louse egg and rabbit lung vaccines and there was no e dence that vaccination had a vinfluence in preventing the infection. No deaths occurred in those that hid been vaccinated except those with the Marburg vaccine but the fatality rates in the two control groups were 33 and 20 per cent The ne dence of the disease was unaffected ty the vaccinat as but to ever ty as much reduced. The amount of ckettsiae introduced for the test must hale bin large since the incubation per ds in many cases were only 4-3 days in the control cases and not much longer in those which had been accinated

Endemic Typhus (Murme Typhus), Brill's Disease

Munne typhus is widely distributed throughout many parts of the world It has been shown recently to exist in the United States Chile and Peru Syna Greece Africa Manchuria Malaya China Indo China and probably the Philippone Islands

Brill a Disease - The di tinction between an endemic form of typhus in the United States and the epidemic European typhu was first pointed out by Brill (808) He recog uzed in New York the pre ence of an acute infectious febrile disease of unknown origin which resembled typhoid but gave a ne ative Widal reaction. There vas intense prostration and an e tens ve erythematous maculo papular eruption. After about weeks the fever abruptly ceased often by crisis. He later (roto-) demonstrated th 8 milanty of this endemic infection to typhus fever but sho ved that it was milder in For many years the condition in the United States has been known as Rull a di ease Br ll noted that the epidemiology of this disease differed considerably from that of epidemics of typhus. The cases occurred sporadically without traceable connection with one another and no localized outbreaks occurred. Also their sensonal distribution differed from that of typhus. These factors led him to the idea that some other vector than the louse might be concerned in transmission. Anderson and Gold berger (or) subsequently pro ed e perimentally that Brill's disease is actually a form of typhus fever The discoveries by Mazcy of endemic typhus in the southern states to be presently referred to also further elucidated our knowledge of Br II s

Zanser has stud ed detailed records of 526 cases of Bulls disease observed in New York and Boston between \$\phi\$ and and 333. Of these approximately \$\phi\$ per-sent focus of it reps bo a individuals who in grated from Russ a Numety see in per cent of all the cuest-form \$\phi\$ to 0 to 1500 were in Jewi Over 50 per cent came from Russ a shore the cuest-form \$\phi\$ to 0 to 1500 were in Jewi Over 50 per cent came from Russ a shore state of the cuest-form of Russ and the cuest-form of the cuest-for

Endemne Typhus in the United States —The discovery of endemic murne typhus in the United States has been especially due to the epdemiological work of Maxcy (1926) in the southern United States – Like Brill in New York, he was unable to explain satisfactorily the nature of the discase and its spread and its seasonal incidence on the assumption that the louse was the vector – The large number of cases which occurred among persons handling food stuffs inclined him to the belief that rats and mice might be the re ervoir and that the disease was transmitted to man by fleas, mites or ticks

Dyer, Rumreich and Badger (1931) and other workers of the United States Public Health Service next demonstrated the presence of the virus in rat feas taken from rats caught in Baltimore Mosser, catemada and Zinsser then found the virus of tabardillo in the brain of Meucan rats and Dyer Rumreich and Badger (1931) demonstrated experimentally the flea as a vector. In a short time the distribution of typhus virus in rats was demonstrated in many countries as a wide spread infection. This murine type has been especially found where opportunities for louse



Fig. 216—From arth le by Dr. R. E. Dyrr. Courtery Am Jour of Tropa at Madason transmission are not great but it has also been found in center, where epidemic typhus also exists, as in Mo con Lemigrad and Istanbul Brill's disease has also been reported in Palestine in tozy there were 85 cases, with but one death. This mild form of typhus has also been encountered in Australia and in North and South Africa. Zinser and several other me stigators hive shown that murne typhus may also pass from man to man by the loose, as well as by the tropical rat field (*Lendps:) The extension of endemie typhus in the southern United States is due particularly to the migrations of the brown rat Pathus in regicus and of the tropical fat flea.

CTIOLOGY

The Virus—The close relationship between the viruses of classical epidemic typhus (Rickelina pro... ch) and of those of the endem c mutine typhus (R mooters or R proto chi var mooters) is seen in the agglutinins of the Wul Felix naction of strains Out and Out of B protons but not against strain Ouk in each type of infection. Consider able but incomplete cross immunity exists between these infections

They moreover may be distinguished by the fact that the murine endemic virus in male guinea pigs induces fever accompanied by a characteristic reaction in the tunica vaginalis with rich production of rickettiaic (the Neil Mooser reaction). With the virus of classical epidemic typhus these animals usually suffer only a slight rise of temperature or the infection may remain inapparent and the scrotal reaction is absent unless the resistance of the animals is artificially lowered as by a vitainin deficient diet. Also in rats the murine endemic virus produces fever sometimes scrotal reactions and after resistance is lowered by irradiations with \rays rich peritoneal accumulations of rickettiaie occur. On the other hand the classical epidemic typhus virus gives rich in rats only to inapparent infections or rarely short fever during which the virus multiplies without causing symptoms and then dies out. Rich accumulations of rickettiane era not obtained in irradiated rats.

Transmission —The virus of endemic typhus is kept alive in nature in rats and its transmitted from rat to rat and from rat to rat to man by rat fleas \(\lambda\) kenopsylla aina and \(\lambda\) cheepis (Mooser and Dyer 1931). It thus is similar to plague in its epidemiology. The rat louse (\(\text{Polyplar symin}\) is well as the flea transmits the disease from rat to rat (Mooser Castenada and Zinnser 1931) but the rat louse does not bite man Pos sibly the tropical rat mite \(Liponysisis\) baceti may also transmit the infect tion in rodents (Does and Shelmize 1931). Infection in man is probably introduced by scratching or rubbing the laces of the flea into the skin but not directly by the bite. The necketissae multiply greatly in the flea so that after about a month one flea may contain enough organisms to infect a very large number of guinea pigs. In other instances the number of ricketisia in the flea may be small in comparison with those in the losse

Rickettsial infections of lice including Pediculus humanus and Polyplar spinulous: the rat louise which is an important transmitting agent from rat to rat are regularly fatal to the louise within a weeks whereas the rat filea. Yendpylla cheopsis apparently is not harmed by the infection and may remain alway and infectious for several months.

may remain alive and infectious for several months.

As noted the murine typius wrine produces a severer reaction when injected into the peritoneal cavity of rats and guinea pigs than does the classical epidemic European strain. In the former the evudate in the tunica vaginalis contains many inclustione and the serotal sac is consider ably swellen. Wolbach (1990) states that this should be called the

tunca reaction to distinguish it from the scrotal swelling occasioned by the inoculation of guinea pigs with Rocky Mountain spotted fever virus In Rocky Mountain spotted fever he regards the scrotal swelling as due to thrombosis of the blood vessels of the scrotal sax wall

In addition to the transmission of the disease by arthropoid fleas and lice there is considerable evidence of the transmission of murine typhus to animals by way of the alimentary tract (Blanc 1937 Volle 1938 Wolbach 1940) Dyer has demonstrated that the facces of infected fleas in the United States contain inclustance and Brumpt (1924) has

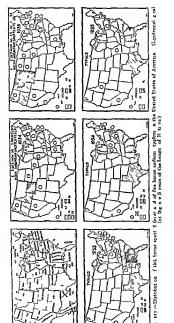
confirmed this in Europe. Nicolle failed to transmit epidemic (classical) typhus to rats by feeding infected lice on them, but Nicolle (1934) and Lechiuton (1938) found that the Rickettist of murine typhus is present in the urine of infected rats and they believe the virus may be transmitted to man by the ingestion of food contaminated with rat urine. One officed rats. The trustoma does not comey the disease to other rats by biting but rats may become infected when they ingest such trationata. The virus of murine typhus may persent for long periods in the brain of rats. Linsers has shown that the murine virus will surjive indefinitely in mouse pas age, whereas the European attenuates in these animals and cannot be carried bewond the third or fourth generation. The murine type is more virulent for rats than the Furopean.

Sparrow and Lumbroso also showed that murine virus was capable of infecting guines pigs when instilled into the nose or placed on the conjunctiva Castenada (1930) also found that intra nasal instillation of murine virus into etherized rats or mice produced a pneumonis characterized by considerable development of necessities.

EPIDEMIOLOGY OF ENORMIC TYPHUS

Geographical Distribution and Prevalence -According to laboratory investigations the virus of the typhus of Mexico (tabardillo), although producing an epidemic di ease which is fouse borne corresponds to the virus of the murine type Elsewhere the murine type is endemic mostly in warm elimates where opportunities for louse transmission are not great It has been encountered in the southeastern United States South America Manchuria Malaya, Syria Greece Africa, China, Indo China, and the Philippines In the United States about 90 per cent of the reported cases have been in Alabama Georgia and Texas In Alabama an average of 60 to 80 cases have been recognized each year, with the disea e confined almost exclusively to the southern and southeastern part of the state, in which regions heavy rat infestation has been encoun tered. The disease still persists in these regions 342 cases being reported in 1038 Bowdoin and Boston (1940) have analyzed 4762 cases which have occurred in the state of Georgia from 1932 to 1938 In this state the number of cases was seven times greater in the white race than in the negro race Nearly one half of the cases in the United States occur in Georgia Musser (1940) reports 115 cases in the State of Louisiana and points out that the disease is increasing there

Dyer (1941) has shown that there has been an almost contunual increase in the number of cases in the southern states since 1929 though there was a slight decrease in 1934 and 1935 following extensive rat proof ing campaigns in Georgia Alabama and Texas. There was also a slight apparent recession of cases in 1936 followed by an increase in 1935. Figure 1935 which he has prepared hows the present distribution of the disease in the United States. As late as 1932 the northern limit of it in Alabama was about on the line with Montgomery. Since that time cases have



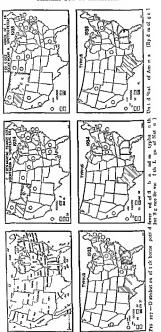
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appeared further north in that state and at present the known northern limit of typhus in this section has reached central Pennessee (1941) reports 75 cases in Nashville * The factors which control the geographical spread of endemic typhus are not entirely clear though the common gray rat is regarded as the most important factor and the distri button of the rat flea Lenopsylla cheapis, which is apparently the most efficient vector i likewise important Dyer (1944) reports transmission to man most probably occurs through the medium of the infected feces of rat flers

The seasonal occurrence of the disease has remained constant, the majority of the cases occurring in the summer and fall. The increased incidence of the disease in Alabama has not been accompanied by an increasing mortality. The fatality rate there has varied greatly with age being less than 2 per cent for persons less than 45 years 5 to 7 per cent for the ages 45 to 64 years and approximately 30 per cent for persons more than 65 years

Marcy s invertigations have shown that the incidence of the disease is twice as high in the male as in the female, that the negro appears to be very much less su ceptible than the white, but that the disease does not prevail in any special strata of society

The maximum occurrence of the disease is in the summer and fall in direct contrast to the prevalence of epidemic European typhus in the winter and spring months Also the case fatality rate is low with a small proportion of deaths in the lower age groups

Some confusion regarding the transmission of murine typhus in the United States was occasioned by the fact that cases of Rocky Mountain spotted fever occurred at the same time in the same states the latter,

however being a tick borne disease

In regard to the virus of Brill's disease Zin ser (1934), after a study of cases in Boston and New York has come to regard Brill's disease as an imported form of the clas ical European typhus which has become estab h hed in America in endemic form and distinct from the endemic typhus of the outhern United States and from the tabardillo of Mexico reports that the virus of Brill's disease behaves in laboratory infections of animals like the European type. He believes that the cases represent recrudescences of old infections originally acquired in Europe and that such cases may serve to maintain epidemic prevalence. According to this view we must consider that in our eastern seaports and in the southern states there are a coexisting forms of endemic typhus one known as Brill's disease and the other as endemic murine typhus In addition cases of Rocky Mountain spotted fever may also be present reports show that endemic murine typhus is increa ing in the southern states while the existence of Brill's disease is said to be steadily decreasing

CLINICAL PEATURES

The clinical course of erdemi typhus is in general similar to that of the enidemic disease except that the symptoms are comparatively mild, complications are rare and the mortality low. In the United States according to Dyer (1941) the mortality is less than I per cent and most of

Dyer (1941) Foints out add tional foci ha e oc urted in Cleveland an I Cin innati

and in Washington D C

the deaths are in patients over 50 years of age Gordon (1940) points out however that the physician with ordinary experience will not always find the distinction between endemic typhus and Rocky Mountain spotted fever simple. The incubation period is from 6 to 14 days in endemic typhus The fever generally lasts about 2 weeks and the temperature is usually normal by the 16th day

Rumreich (1933) points out that the disease may either begin abruptly either with a chill or childness with slight fever or start gradually with irregular development of the symptoms the temperature rising progres sively day by day reaching 102 to 105 F in 3 to 6 days and lasting about

ra days to fall by rapid lysis

The rash the most characteristic finding appears as in epidemic typhus about the fifth day usually on the chest and abdomen and medial surface of the arms It may not extend further or it may spread and involve the whole body the feet palms and soles usually being excepted In character it consists of rose or dark red macules fading into the sur rounding areas. The macules do not disappear on pressure. Though similar to that of epidemic types at is usually less extensive and petechiae are less common. Extensive slin necroses have not been reported The rash lasts from a to to days when it rapidly disappears

The mental condition is much less altered than in epidemic European

typhus and the dehrum of the latter is almost wholly lacking

The diagnosis and treatment of endemic typhus has already been discussed under epidemic typhus Since the disease is usually so much milder but little treatment is often required

PREVENTION

Since endemic typhus is similar to plague in its epidemiology satis factory rat proofing is undoubtedly an important means of prevention Rat extermination campaigns through poison and trapping are also of value

Bowdoin and Boston (1040) have reported that rat proofing was the only permanent method of control in the state of Georgia Educational campaigns in rat control measures may be of value

Prophylactic moculation for epidemic typhus has already been considered p 951 Dyer (1941) has considered the use of a vaccine to control endemic typhus but in his opin on this may be dismissed from consideration since cases of endenic typhus in the Un ted States are relatively few in number and their occurrence is sporadic. To effect any demonstrable decrease in the number of cases would require vaccination on a scale th t is not warranted in the light of our lack of knowledge of the prevents e value of our present vactines. Also a vaccination program against endem c typhus could only be expected to prevent typhus in the vaccinated and vidual and would have no effect a reducing the exposure to af ction of other and iduals since an an mai other than man is the reserve t of the infection

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Chafter XXVI

SPOTTED FEVER OF THE ROCKY MOUNTAINS

DEFINITION AND SYNONYMS

Synonyms -- Rocky Mountain fever Tick fever of the Rocky Mountains Black fever Blue disease

Definition —An acute specific infectious rickettistal disease transmitted by ticks. It is characterized chinically by an onset with a chill and continuous moderately high fever terminating in lysis, severe arthritic and muscular prins and a profuse macular eruption on the skin later becoming petechial and appearing first on the ankles wrists and back but rapidly spreading to all parts of the body.

HISTORY AND GLOGRAPHICAL DISTRIBUTION

History—The disease was first noted in the Snake River Valley of Idaho about 1893 and in the Bitter Root Valley of Montana about 1890. There is some evidence that the disease may have existed among the Indians prior to the advent of white settlers in the Bitter Poot Valley It is interesting to note that the first white settlers of the Bitter Root Valley suffered from what was considered a very fatal form of black measles

The disease was observed by Dr M W Wood U S A in 1806 and by Maxev in 1899. For many years it was supposed to be confined to he northwest mountainous regions of the United States especially Idaho and Montana, with occasional cases in Wyoming, Utah. Nevada and California. However in 1900 in connection with the study of endemic typhus in the United States the Public Health Service estab hished the fact of its custence in the Allegheny region and it has now been reported from almost all of the states.

In 1902 Wilson and Chowning reported that the di ease was trans mitted to man by the bite of the tick (Dermacentor andersons). At that time they thought the infection was due to a priplasma. Later Ashburn and others while accepting the tick transmission failed to corroborate the purpolism as the ethological factor.

It is chiefly to Ricketts that we owe much of our detailed knowledge of the transmission and epidemiology of the disease. The work of McClin the and Frick along lines of prophylans has given to practical measures for its control and Ricketts Wolbach and Frick have also made valuable.

observations regarding the etiology of the disease

Geographical Distribution -Prior to 1930 the disease was believed to be confined definitely to states west of the Mississippi River that date Spencer and Maxcy (1930) and Carey and Duncan (1938) have shown that its geographical himits have been greatly extended in the central and eastern states The more recently discovered form of Rocky Mountain spotted fever has become known as the eastern type of the disease and of the eastern states Maryland Virginia and North Carolina have shown the greatest number of cases In 1937 31 states reported cases of Rocky Mountain spotted fever several of which were contracted in Massachusetts Of 100 cases reported for the entire country from 1933 to 1937 65 5 per cent occurred in the mountain and Pacific states and 74 per cent were in the south Atlantic states These two areas combined accounted for 93 per cent of the total reported cases for the entire country In 1938 the Public Health Service reported a total of 278 cases though it was stated that these figures were preliminary and incomplete Hampton and Eubank (1938) point out that the number of cases of spotted fever in the eastern states has gradually increased

Philip in August 1939 reported that eases had occurred in all states with the except on of Kansas Wi consin Michi an Connecticut Rhode Island New Hampshire

Vermont and Maine

It is now believed that the exanthematic fever of Sao Paulo Brazil and flever boutonnesse Marss lies as well as the tick bite fevers of Africa are closely related diseases and that the c usative agent of each is closely related to the other and that

all may be included in the spotted fe er group of the genus Rickettina

Lui Patino Camargo (1941) has repo ted a new American focus of Rocky Vious turn Spatted Fever in the interior of Colombus. South America. The first cases busing alentified during an ep dem on the Wagdalena aver bas n amo g a rural population along the Tobus inver: There were of cases of Spotted Tever with 65 deaths during a first of the first cases of t

ETIOLOGY AND EPIDEMIOLOGY

Ehology —The disease is due to a species of Ricketisia R rickettisis Rickets noted certain chromatin staining by our broad and showed chromatin staining resembling somewhat B influte are They appeared as two lanceolate shaped bothes. These bodies are now recognized as belonging to the group of organisms known as the Rickettisia Wolbach who studied the disease in 1919-20 named the organism of spottled fever of the Rocky Mountains Dermaceutrozenss rickettis: It is now classified by most authorities in the Genes Rickettins.

Recettists recettly like other organisms of the genus is minute bacterium like and does not stain well with aqueous solutions of ordinary bacterial stains. Gienna's stain is best for its demonstration. In man and susceptible animals it has been found constantly in the lessons of the disease. In the tick, which transmits it is undergoes 2 definite morphological sequence. It has not been cultivated on artificial media but only in tissue cultures for long periods. These cultures remain virulent for laboratory animals for long periods. These cultures of the organisms of Rocky Mountain spotted fever and typhus bave been studied by Pinlerton who finds

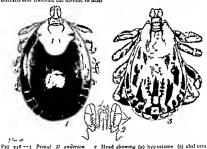
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that both in cultures and in the ticl. Dermacentroverus ricketts invades and multiplies within the nuclei of cells while Rickettiza prina et grows only in the cytoplasm of the cells. The organism is transmitted in the tick from generation to generation, and hence the maintenance of the disease may be independent of human or animal passage. The virus is extremely susceptible to physical and chemical agents although it may survive in a frozen and described exist for a considerable period.

Animal Susceptibility—The discuse may be transmitted to monkeys rabbits and guinea pigs. White rais and mice are said not to be susceptible. Infected ticks have been taken from rodents in the Bitter

Root Mountains and from the Rocky Mountain goat

Ricketts reported that a reservoir of the virus was to be found in ground squarrels chipmens and mountain rats and that tacks feeding on these rodeots might become infected and transmit the disease to man



(c) palps 3 Male

The virus can be propagated indefinitely in guinea pigs without loss

of virulence by weekly inoculations into another animal

Transmission — Transmission of the disease in the western U S is by

the tick. Dermacentor andersons the common wood tick of that region As the virus is transmitted to the egg the infection can be kept up in the tick without another reservoir of virus. However, numerous animals of this area are susceptible and undoubtedly play a part in the transmission of the disease to man although none have been found naturally infected Unlike epidemic typhus man has no often in the transmission of this disease. In the eastern states D variables is the natural vector. It is the common dog tick of that region. Only adult ticks commonly attack grown persons while the larvae and nymphs infest small mannais particularly rodents. Endemiodry—The usual and perhaps only method of transmission

Epidemiology—The usual and perhaps only method of transmission in nature is through the bite of the tick. Animals cannot be infected by

contact and no instances of contact transmission from man to man have been reported. The disease is usually one of urual communities and generally only one case is found in a house which also indicates the improbability of contact infection as well as the transmission of the disease by bedbugs and bee

It is at the time when ticks are most abundant that the disease is most common and the seasonal modence of spotted fever corresponds to the tick seasons of the locality coocerned. Thus in the northwestern regions of the United States the tick. (Dermacenter andersons) is most prevalent from the middle of March to the middle of June and in that region the majority of the cases of spotted fever occur in April May and June with occasional cases in March and July and September. In the eastern states the tick. Dermacentor variabilis (the dog tick) appears in March and December most of the cases occurring in June July and August. The greatest number of cases occurs in persons engaged in outdoor occupations which take them into tick infected areas as adult males. In the eastern states, infection of women and children is more common perhaps because of dogs bringing ticks into the house.

Ambinoumm am r can im has been found naturally infected and the immature stages also attack man. Potential agents are Demiscosico o cidental's the Pacific Coast tek Ambinoumo cup emiser Teras and Florida and Rhipschophius in numeri the brown dog tick which, found along the Gulf coast and Demiscosir pa un apartus corting on rubbin in the southern Rock. J Mountain rego and along the Pacific Coat. Now the c us a tendency to disregard separation into the Easte na d Western types according to vinlence (Topon 1944).

The age distribut on of western and eastern spotted fever shown some differences as in the east the higher percentage of cases occurs in the age group 5 to 9 years. Also in the east the distribution is more even between the sexes. The life in the east with vacation treks during summer tends to bring all ages and both sexes into areas where the dog trick is prevalent.

A few mistances of infection have followed crushing of the ticks and removing them from dogs. The virus is present in the blood of man during the entire febrile course of the disease.

PATHOLOGY

The cadaver sometimes shows marked jaundice with petechial spots on extremities and trunk There is marked venous engorgement and the blood is very dark and fiuld and clots slowly

The pathological histology is in many respects similar to that of typhus. In the male there is frequently actensive hiemorrhage and necrosis in the tissues of the scrotum and there may be necroses of the skin of the customers of the scrotum and there may be necroses of the skin of the ears face fingers: toos and valva. The spleen is usually several times the normal size. It is firm and dark red. Rickets noted especially enlarge logical pathological changes. The distinctive features are those connected with the distribution and character of the blood vessel lessons in the skin and sub cutaneous tissues and in musicles and in the respendiges. Haemorrhages into these tissues are almost constant. The heart shows no peculiar change and the myocardium is usually normal. Changes of the lungs are not common though occasional honocho pneumona may be present. The gastro-intestinal tract pan creas liver adrenal glands and kinderys show no gross changes. The heart show some injection of the blood vessels of the pan archingle.

Wolbach found microscopical lesions of the blood vessels in the skin and sub cutaneous tissues taken from all parts of the body, in the testes in the skeletal muscles rarely in the blood vessels of the thyroid and gastro-The vascular lesion at first consisted of a proliferative reaction of the endothelium followed by necrosis with thrombus forma tion. The rickettsiae are found in the endothelial cells and in smooth muscle cells of the blood vessel walls Permascular accumulations of cells occur though they are not so striking as in typhus Small focal necroses may be present in the liver, as in other infectious diseases. The spleen may show extensive engorgement with blood and marked phagocytosis of red blood corpuscles There is almost complete depletion of lymphoid cells Wolbach did not observe lessons of the central system in the western form of the disease either in man or in guinea pigs artificially infected However I illie has reported focal brain lesions in 4 of the eastern cases which were fatal. In a subsequent report (1941) he found such lesions throughout the brain in all cases fatal after the twelfth day but only occasionally in the earlier fatal cases. In addition to the lesions resem bling the e found in epidemic typhus there were arteriola thrombo necroses with surrounding infarctions. In the easiern cases, enlargement of the spleen 13 said to be less marked and the haemorrhagic lesions of the skin and serous membranes are less common than in the cases of the western type

The pathology of Rocky Mountain spotted fever in animals such as guinea pigs rabbits and monkeys is similar to that ob eried in man

Symptomatology

The period of incubation is from 3 to 7 days when the disease sets in with considerable abruptness with more or less marked ingors headache malase and severe pains of the larger joints but without inflammatory changes. In milder cases the incubation period may be as long as 14 days. However, in 2 experiments upon human beings in which the disease was transmitted by a tick the incubation period was 3 and 9 days. Some of the cases present a producional period lasting a day or so with malaise and chilly sensations followed by the symptoms noted above. Hyper aesthesia and photophobia pre apt to be present during the course of the disease.

The eruption fir t appears from the second to the fifth day as rose colored macules about the wrist and ankles thence spreading over the extremities and extending to the trunk, and forehead. The rash appears later on the palms of the hands and soles of the feet and scalp. Some times it is present on the evelds and the mucous membranes of the mouth and obsarva. The macules tend to become petechal.

The pulse at first is not very rapid (90-r20) and the fever rises steadly day by day from the initial 102°F to reach a maximum of about ros F by the end of a weck or so In very evere cases in the Bitter Root Valley, temperatures from 106-107°F have been recorded The fever holds during the second week with hight morning rems usons. When recovery occurs the temperature usually begins to fall at about the end of the second week continuing by lysis or bath normal temperature is reached at about the end of the third week. In fatal cases the temperature may

drop to normal or sub normal only to rise shortly before death which usually takes pluce between the sixth and twelfth days of the disease. The pulse is at first full and strong but gradually loses volume and about the fifth day becomes weaker and more rapid usually ranging from 170 to 140 or even higher before death. In midder cases bower it may not exceed 90. The respirations are usually increased and frequently to 30 or 40 a minute or even higher before death. The lungs are usually not involved but there may be a mild bronchial cough. A toxisemic condition appears early. A stuporous state is fairly common but in many cases the mind is clear throughout the course.

The spleen may be palpable early in the disease and quite firm not soft like the spleen of typhoid fever Kidney involvement may show itself early as an albuminuma Constipation is rather a constant feature



Fig 219 -G ne 1 zed crupt n f potted fever of the Rocky Mountains (Cou te y

Idenus and vomiting tend to come on later in severe cases Gangrene of the tonsils scrotum and prepute are more common in reports of the milder type of the disease a seen in Idaho than in the more severe cases of Montana Necroses of the fingers toes vulva lobes of the ear and mucous membrane of the soft valate may occur in the third week

Nervous Symptoms—In some localities restlessness and insomnan have been reported as common throughout the disease and constitute its most distressing features. Hyperesthesis may be severe Delirium is frequent in severe cases during the height of the fever and coma usually precedes death by a few hours or a day. Wolbach has found convulsions rare. There is occasional musicular rigidity and opisthotonus. Pneu monia which is rare is practically the only complication. In uncomplicated cases there is a moderate leucocytosis early in the disease falling to about 10 ooo or 11 000 after a few days. There is an increase in the

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large mononuclears The cosmophiles are decreased and may be entirely absent. The red cells are often decreased in number as the disease progresses and may fall below 3 500 000

DIAGNOSIS

The disease must be distinguished especially from cerebrospinal meningitis, typhoid fever and measles, as well as from the other typhus Cerebrosomal meningitis generally shows more marked nervous symptoms and rigidity of the neck. There is also a much higher leucocytosis in meningitis and the blood culture or spinal fluid examination should differentiate The macules of measles are somewhat similar, but are more dusky red and are in abundance on the face, and Koolik's spots are present. Then, too the enryza of measles is absent

More sudden onset, joint pains and negative Widal reaction differen trate it from typhord fever The differentiation of Rocky Mountain spotted fever may be made especially by the moculation of the guinea pig The guinea pig while susceptible to both typhus and spotted fever is more easily infected with the latter and in typhus fever usually shows only a febrile reaction, while in spotted fever there is generally an enlarged spleen and scrotal swelling and necrosis. Nevertheless the strains of spotted fever virus isolated from various parts of the United States and South America differ in the reaction which they produce in the guinea pig Wolbach has found that typical western spotted fever virus regularly causes dry necroses of the scrotum a cause of the severity of the vascular lesions while eastern spotted fever only rarely produces conspicuous lessons of the scrotum Occasionalis it has produced infiltration of the tunica vaginalis similar to that of epidemic typhus Pinkerton has reported that a strain i olated by Reimann from a case in Minnesota and one by Monteiro in a case in São Paulo produced involvement of the tunica vaginalis in guinea pigs with considerable regularity. The eastern strain of spotted fever of Rumreich is said to produce focal lesions in the brain of guinea pigs while typical western strains and the Minnesota strain did not These confusing factors with different strains are not yet entirely explained They have suggested to some authors the occurrence of strains intermediate between typhus and spotted fever Wolbach believes however that the morphology and grouping of the intracellular parasites found in the scrotal sac is sufficient for diagnosis in the hands of one who is familiar with epidemic typhus and spotted fever virus. In tissue cul tures, the organisms of spotted fever invade the nuclei of the cells while typhus rickettsiae invade only the cytoplasm Differentiation can also he made in laboratory animals by cross immunity tests since neither disease confers immunity against the other

The geographical distribution of the disease and the association of the tick bite may also be of value in diagnosis. In fievre boutonneuse and tsutsugamushi disease there 1 a local lesion present while in the latter disease the virus in immunologically distinct from either the Rocky Mountain spotted fever group or the typhus group (see p 946)

A positive specific Rickettsia complement fixation test may be obtained and is usually present about the 10th day and may persist for years after convalescence This to I serves to differentiate the disease from either spadem c or endemic typhus Reagan and Wertman (1944) have found the test of particular value in separating it

from other forms of rickettsial disease

PROGNOSIS

The mortality of the disease has varied considerably in certain local ities For the whole United States it has been given as about 23% It is somewhat remarkable that the mortality in western Montana has been reported rather constantly as approximating 75-90 per cent and in Idaho not over 5 per cent More recent reports state that in western Montana it is about 15 per cent In the past few years there bave been fewer cases in Idaho but the mortality has increased to about 25 per cent In the eastern states from 1933 to 1936 465 cases occurred in the South Atlantic states in which the mortality was 18 i per cent In the same period for 1230 cases in the mountain and Pacific states it was 10 4 per cent (Hampton and Eubank 1938) The Public Health Service has suggested that the mortality has been greatly reduced in recent years in some areas of the Rocky Mountain region by vaccination This however does not explain the differences in mortality in earlier years. In Brazil the mortality of Sao Paulo chsease has been in the neighborhood of 80 per cent

Where the nervous manifestations are marked the prognosis is more unfavorable. Death tends to occur in the second week and patients living through this week have a good chance for recovery. The death rate is greatest in old people and least in young children

PROPHYLAXIS AND TREATMENT

Prophylaxis —The general measures for the control of the disease in the Bitter Root Valley have been directed especially toward the reduction of numbers and the climination of the distribution of ticks. Some success has been obtained there in the destruction of the small mammals which act as hosts of the larvae and nymphs and also the dipping of cattle which are infested with adult nymphs. Clearance and cultivation of the land in some areas has rendered the locality comparatively safe against infection. In most regions bowever where clearing and cultivation of the land cannot be carried out prevention of the disease by the control of tick carriers has not proved practicable.

Brumpt has suggested the introduction in the United States and acclimatization of hymenopterous insects (Ixodiphagus) which are parasitic upon and destructive to various genera of ticks — So far at least some of the attempts have proved unsatisfactory.

Personal prophylaxs depends upon avoidance of tick bites. If one has to visit tick infested regions protective clothing should be wornhigh boots leggings puties and heavy socks worn over trouse leggings should be employed as ticks will crawl up the outside of clothing. Carriell impaction should be made of the body daily and particularly the back of the neck as well as made the clothing. Democration anderson usually requires a long time to become attached and feed on the buman bost—at least one or more hours—hence impaction of one a person for ticks after returning from exposure and removing those found would tend to prevent infection.

When these ticks attach themselves to the wool of grazing sheep 87 per cent seem to die possibly from the effect of the fat in the wool Again such sheep can be dipped for further destruction of the ticks

There is no satisfactory repellant which can be placed either on the

clothing or on the body to prevent tick attachment

Protective Inoculation.-Spencer and Parker (1935) have used a phenol formalized emulsion of ground up infected ticks (Dermacentor andersoni) against Rocky Mountain spotted fever The inoculation is said to produce as a rule only slight local symptoms although occasionally there may be headache some fever, and general malaise for 24 to 48 hours Rarely there may be an urticarial rash but such cases usually clear up without serious consequences Parker has reported that only 64 out of re con vaccinated in an endemic area developed spotted fever Protection was complete against the mild Idaho virus the morbidity falling among the highly exposed shepherds from 6 per cent in the unvaccinated to 0 5 per cent in the vaccinated while against the highly virulent Bitter Root Valley virus of Montana, protection was shown by a fall in fatality from 82 per cent among the unvaccimated to 6 6 per cent among the vaccimated Similar protection was given to laboratory workers handling the Bitter Root virus infection occurred in 22 cases, and of 7 not vaccinated all were fatal whereas among 15 vaccinated only I died. Since 1940 the vaccine has been prepared from the chick embryo by the yolk sac method of Cox For active immunication the National Institute of Health recommends either three r cc injections or two 2 cc injections given subcutaneously at 7 day intervals

Montiero (1933) showed that with the South American tick Ambly oming agrenience a similar vaccine could be prepared effective in guines pigs against North American spotted fever and São Paulo tick typhus and Canet (1914) also produced a spotted fever vaccine using the European

tick Dermacentor reticulatus

Gordon (1940) points out that the protective value of this prophylatus is definite but the degree and duration of protection varies with individuals and with the virulence of the infecting strain. While children may be fully protected against the usual fatal form of spotted fever adults are only occasionally protected.

Parker (1941) has reported the results of 15 years of prophylactive vaccination and finds the vaccine has definite immuning value. The average vaccinated person maintains for somewhat less than a year an immunity of sufficient degree to affind protection against relatively mild strains. Parket thinks immunization each year is the only safe procedure.

Statement— hypermonone rabbat serum has been elaborated by Topyong and secommended by him for treatment. The study es of Topyong and secommended by him for treatment The study es of Topyong and of Pinkerton (1944) show that the sulfonamides are medicture and possibly detrimental from experiments performed on laborators avanuals. In agencial treatment should be symptomate Just as with typhus fever the most amportant point in the care of the print at a good nursing. The comes should be darkered and quite maintained. Cost sponging to exist the temperature are most sometiment of the contract of the cont

Wolbach (19,7) suggests that on theoretical grounds the transfusion of blood from an immune donor should be tried when opportunity occurs in the early stages of the disease

SPOTTED FEVER GROUP

TICK TYPHUS TICK BITE FEVER FIEVRE BOUTONNEUSE

The rickettsial diseases of man transmitted by the family of ticks Irodidae are now known to be of wide geographical distribution and include fievre houtonneuse (Marseilles fever) escarro nodulaire of the Mediterranean countries and tick bite fever of South Africa Kenya India and South America There is evidence that these diseases are closely related to one another and to the Rocky Mountain spotted fever of North America. Fievre boutonneuse was first described by Connor and Bruch in 1910 in Tunis Subsequently different French and Italian observers reported the existence of a disease in the Mediterranean regions and in Marseilles and among other districts in southern France as well as in Italy Portugual Spain Greece and Rumania The disease was said to resemble the mild typhus reported by Brill and Maxcy in the United States but small black spots of linear appearance resembling insect bites were often reported tache noir and there was no history of lice infes tation It was stated however to be different from Brill's disease by the fact that the Weil Felix reaction was generally negative but more recently positive reactions have been frequently reported. Subsequently the infection was observed in Senegal and Sierra Leone (Gordon and Dahey 1036) and in Pretoria South Africa by McNaught and by Piper (1934) In India in roir McKechnie described a mild sporadic form of typhus in the northwestern Frontier district, and in 1016 Megaw himself suffered from an attack Cases have also been described by Scott in Lucknow In 1932 Combresco reported an outbreak of 34 cases in Rumania Tickborne typhus has also been reported by Holmes in Australia and hy Montierro in Brazil and Patino Camargo and others in Colombia

Transmission—Fièvre boutonneuse is transmitted by the common dop under the Rhiptepholius sangumeus (Durand Conseil and Brumpt 1939) Durand has shown that the dog constitutes the reservor of the virus Dogs have been shown to be susceptible to inoculation and their blood has been proved to be infective both for man and monkeys.

A distinctive feature of februs boutonnesses is the appearance of the primary sore at the site of the infective text, but it is varies in are form a pan head to a pea and it is not usually painful. Lymphangitis which becomes necrotic or gangrenous subsequently occurs. The initial lesion is known as tache noir. French investigators have hesitated to include filter boutonnesse in the typhus group for the reason that the Weil Felix reaction. Yig was often negative. The Neil Micoser reaction in guineap pigs was also reported as negative. Cammonetros (1612) how.

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ever reported in Greece that if an emulsion of infected ticks is injected title guinea pigs these animals react in the same manner as when an emulsion of infected fleas containing the virus of murine typhus is used a scrotal reaction being, observed

In South Africa the disease closely resembles fievre boutenneuse and is conveyed by larval ticks Amblyomma hebraeum Rhipicephalus appends culatus, Haemaphysalis leachs and Boophilus decloratus. The small ticks are not found in houses or on domestic animals but are encountered on the grass and attach tiemselves to man or animals living in the veld In this respect the transmission of the disease is somewhat similar to Rocky Mountain spotted fever

Rickettsae have been demonstrated in the infected ticks and an emulsion of these has produced the disease in man and animals. In South Africa however, an agglutnation for proteus \(^1\) strain has been reported, where two forms of this fever have been met with \(^0\) like the kedani fever of Japan with a local lesion at the point of infection with local lymphanguis. There is practically no mortality. In another form the fever lasts for 8 to days, with a primary sorte, severe headshe, appearance of rash on the fifth day, stiffness of the neck and conjunctivities. A definite Weil Felix reaction to all three variations of Proteus \(^1\) has been reported. No animal reservoir is yet known by Piper excludes dogs. The immunologic data Zunsser reports are confusing cases have been reported by Gear and Bean in Johannsburg as well as in Kenya. Gear and Douthwaite regard the dog as the re ervoir of infection in Cape Colony.

Puper and trocker (1938) have found in South Africa a appraish typhus write immunologically identical with a varius in rast that protected against the bufe ever but not against explore the typhus write present the rat is reported by Monitero as the receiver of the virus and the distribution of the present the rat is reported by Monitero as the receiver of the virus and the distribution is transmitted by Amblyomera cogramme. This is an extremely virulent form of spotted fever. Tallor reports that in this form the Well-Flor reaction is supported that the valuable of the present that in the property of the present but in low dilution. Data (1938) states that the natural reservoir hosts of the Brazilian form are the opensum the domestic and wild dog (Consideration) the present of indivisional I cay intensit. A strict in and I brazilian Davis (1933) reports experimental transmission of the spotted fevers of Brazil Colombia and the United States by Or risk O parker and O nicellar. The last is a Marcian specie is spotted fever be assys; I rot known to occur in Versco. The spotted fever virus was found to press through four gebrations in O parker.

Pathology—Fubve houtonneu e is distinguished by the occurrence of the local, granulonatous lesson which usually ulcerates. It is accompanied by adentits of the regional lymph nodes. According to Bal tazard (1936) the rickettisae multiply in this lesson in contrast to their behavior in Rocky Mountain spotted fever. There is no published account of a postmortem examination on a human being. The only histological descriptions are of the maculo-papular cruption by Olmer (1933). Marked swelling of the vascular endothelium is described accompanied by pervisaenlar infiltration of leucocytes, regional lymphotytes and monocytes. Thromboses are not mentioned. The purpuir

lesions were accompanied by extreme congestion and haemorrhages of the papillary and subpapillary plexuses

While clinically fievre boutonneuse like tsutsugamushi disease has a local lesion and adenopathy Hass and Pinkerton (1036) believe that it has generic relationship with the virus of Rocky Mountain spotted fever and Parker and Davis (1933) and Dyer (1933) have shown that the Sao Paulo virus cross immunizes completely with that of Rocky Mountain spotted fever Plotz (ro44) has found that Fievre Boutonneuse can be differentiated from Rocky Mountain spotted fever by means of comple ment fixation provided purified rickettsial antigens are used. This test may be employed with convalencent guinea pig or human serum thus providing a convenient laboratory test for diagnosing Figure Boutonneuse There is some cross fixation between this disease and Rocky Mountain spotted fever indicating they are antigenically related

Q faver caused by Ricketts a b rnetts (R disposes) has been referred to on page It occurs in Australia and cases have been reported in Montana. It probably exists in other western states since specific antibodies have been demonstrated in the blood of individuals hving in Idaho Montana Wyoming Nebraska Nevada Arizona and Washington state. Cases reported in Washington D. C. (Dyer Topping and

Bengston 1940) were probably due to laboratory infection

Transmission -The disease in Australia is believed to be transmitted to man from the bandscoot a marsumal Isodon torosus or I macrurus by the tick Haemaphysalis humerosa There is evidence that cattle may also serve as a reservoir of the virus in Brisbane Derrick (1944) has summarized the Australian outbreak in which 176 cases were diagnosed in Queensland Nearly all of 1 o patients who lived in Brisbane were associated with meat works most of the 47 other patients worked on dairy farms Ticks on cattle are probably the source of human injection. It is suggested that inhalation of tick feces is the likely mode of entry of R burnets Davis (1943) reports experimental transmission of American Q fever by O moubata and O hermsi

Clinical Features - The incubation period in the Australian cases has been given as from ro days to one month. There is an acute onset with fever prostration and headache accompanied by chills and sweats. The acute stage may last from a few days to several weeks There is no leuko cytosis and no rash In the laboratory cases in Washington chest pains coughing and in some instances rales were present. Some of the cases resembled those of atypical pneumonia of the form described by Longcope (1940)

In a fatal human case reported by Lilbe Pern and Amstong (na) the grass patholog cal findings were pulm na y edema and congestion firm granular consolida tion of the upper lobe of the right lung poste so ly and a la ge soft spleen M cro scopically the les ons in the lung we the se of an atypical pneumonia with much fibrin in the all con and bronchioles with a moderate mononn lea cell eaction instead of the pu ulent one seen in typical bacters I pn um min. In neither the human lungs nor i the lungs of infected monkeys was Rickettsia demo at ated h stologically

Diagnosis -In the second week complement fixation antibodies against R burnetts have been demonstrated in the blood serum. The organisms had been isolated in guinea pigs by the inoculation of blood ever reported in Greece that if an emulsion of infected ticks is injected into guinea pigs these animals react in the same manner as when an emulsion of infected fleas containing the virus of murine typhus is used a scrotal reaction being observed

In South Africa the disease closely resembles fievre boutonnesse and is conveyed by larval ticks, Amblyonma hebraeum Rhipicephalus appendictions and the second ticks are not found in Pouses or on domestic animals but are encountered on the grass and attach themselves to man or animals living in the veld In this respect the transmission of the disease is somewhat similar to Rocky Mountain spotted fever

Rickettsiae have been demonstrated in the infected ticl's and an emul ion of these has produced the de ease in main and attinuals. In South Africa bowever, an aggluination for proteus X strain has been reported, where two forms of this fever have been met with One is midd, like the kedant fever of Japan, with a local lesson at the point of infection with local lymphangitis. There is practically no mortality. In another form the fever lasts for 8 to o days, with a primary sore, severe headache, appearance of rash on the fifth day, stiffness of the neck and conjunctivities. A definite Weil Felix reaction to all three variations of Proteus. A has been reported No animal reservoir is yet known but lipper excludes dogs. The immunologic data, Ziris er reports, are confusing cases have been reported by Gear and Dean in Johannesburg, as well as in I enya. Gear and Douthwaite regard the dog as the reservoir of infection in Case Colon.

I typer and Crocker (19.8) have found in South Mrica a spondic typhus virus immunologically indentieal which are virus next at the protected against the bite fever but not against a fidenic typhus. In Brazil, where the no called Sao I and typhus it not against a fidenic typhus. Believer but not against a fidenic typhus in Brazil, where the no called Sao I and typhus its present the rate Monterora site feer revor of the virus and the disease is transmitted by imblyonews a percent. This is an extremely virulent form a spotted fever. Tallot reports that in this form the Vell Pelic reaction is usually resent but in low distution. Dust (19.98) states that the natural reservoir hosts of the Bra shan form are the open-size much while dog (Cennule's Fever) had rabbit (Salidigus minerati) and the agonut (Datypeods). Vectors are exertal species of imblyonium of convenients at streatum and the bearliers Davia (19.31) respectively of the streatum and the bearliers of Davia (19.31) respectively of parlier and O medil 1. The last is a Vereion species spotted fever he says is not known to occur in Mesto. The spotted fever virus was found to create through four generations in O perker.

crisist through four generations in O perkin
Pathology —Fiver boutonnesse is distinguished by the occurrence
of the local granulomatous lesson which usually ulcerates It is accom
panied by adentits of the regional lymph node. According to Bal
tazard (ro36), the rickettsiae multiply in this lesson in contrast to their
behavior in Rocky Mountain spotted fever There is no published
account of a posimoriem examination on a human being The only
histological descriptions are of the maxulo popular cruption by Olmer
(1933) Marked swelling of the visicular endothelium is described
accompanied by perivascular infiltration of leucocytes, regional lympho
cytes and monocytes Thromboses are not mentioned. The purpuic

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Chapter XXVII

TSHTSHGAMUSHI

(Japanese Ruer Ferer, Mite Typhus Scrub Typhus)

DEFINITION AND SYNONIMS

Synonyms -Flood fever Japanese river fever Kedani mite disease Shimamushi

Definition—An acute febrile disease caused by a species of Rickettisia and transmitted to man by the bite of the larval kedain mite of the region where the infection prevails The onset is characterized by headache and gaddness a rather rapidly rising temperature and swelling of the lymphatic glands draining the region in which is situated a small nearont culter marking the site of the bite. With impected conjunctivae continuous fever and hyperaesthesia the disease continues for about a week when a macular eruption appears about the face the chest extremities and trunk. About 10 days after the appearance of the eruption there is a full of fever by I iss

HISTORY AND GEOGRAPHICAL DISTRIBUTION

History—There are records which would indicate that the disease has been known for more than 1000 years. The first chitical report of the disease was published by Palm in 1873 and by Baelz and Kawakami in 1879 who gave it the name of river fever or flood fever since it was found to prevail along rivers especially in conjunction with floods. Hatori 1911 reported that it was identical with the endemic examinematic and

bubonic diseases of Formosa

Geographical Distribution —It is in the western part of the island of Nippon when the banks of the Shinanogawa are imundated each spring that the disease has been especially encountered. It formely was supposed to be confined to Japan although Ashburn and Craig (1908) thought an affection observed by them in the Philippines was probably identical. Later it was recognized that tsutsugamush occurs in Formosa and probably in Korea. Fletcher reported cases from a military camp in the Malay Federated States and it is now believed that Mossman fever of Northern Queensland studied by Brein! Priestly and Field (1974) may be a similar affection cases have recently 1942 been reported from Cape York pennisula Austraha Schuffner's pseudo typhus observed in Sumatra is also recognized as analogous chiracilly and etiologically More recently the disease bas been reported in the Malay States by Dowden and by Fletcher and Field (1974) and by Lewthwatte and Savoro



endothehal phageogues of the tusues of the local lesson of lymph nodes and spleen. The organisms were also observed in the blood plasma and in severe cases in the red blood cells. He was able to transmit the infection to monkeys guinca pigs and rabbins and bas classified the organism as Theierra and named it Theilera instingumnish. It has since been shown that it should be classified in the Genus Rickellisia. Sellards (1923) proposed the name of R. nipenta for it. The presence of ricketistae as the etiological factor has been confirmed by Ogata (1931) (R. Isultinga mushi) and by Agago et al. (R. orientalis).

The virus is present in the blood of a case even in the incubation period and as little as o coil cc may transfer the infection to the monkey. After the height of the fever has been passed it may require o rick to infect Spleen emulsions bring about infection but the virus loses its potency in about 6 hours after death. A temperature of 5 C for in minutes kills the virus. Nagayo found the organism in the eggs as well as in the bodies of mites but was unable to cultivate it on ordinary bacteriological medium. More recently it was studied in tissue culture (Noshida 1935). It also has been shown that the disease may be propagated serially in rabbits by the injection of the virus into the testicle where the rickettsae are present invading the interstitial cells. Nagayo has also transmitted the virus by intra ocular inoculation of the guinea pig. The rickettsiae develop within the coronal endothelial cells overlying. Descemet is membrane

Transmission —The disease is not communicable naturally from person to person and only follows the bits of certain larval mites. In Japan Trombicula adamush is commonly called the Kedant mite. It is an orange red larval mite scarcely visible to the naked eye about 400 by 2004. The mites are very harry and live inside the ears of the field mice of the area of Japan in which the disease occurs. The adult forms live in the soil of the endemic area. They are about 1 mm long by 0.5 mm wide. The hexapod larva usually attaches itself to the audilar or groin regions and drops off after engorgement leaving an eschar from which adentite develops. The ricketiaal infection which is transmitted by the larval bite is inherited from the parent—the larva not feeding a second time. This mite is said only to be a source of danger in regions in which the disease occurs especially along nundated river banks its bite not producing the diseases elsewhere

Epidemiology—In Japan and in Formosa the disease is most fre quently contracted during the summer July and August and less so in June and September though occasional cases occur in other months. It is particularly during the barvesting of the hemp in the summer that

individuals are liable to contract it when bitten by the mite

The adult mites and nymphs feed only on plants and hence are not parastic and do not act as vectors. Hayash has shown that the field mouse (vole) literatus monthellos may serve as the reservoir of the virus which is transmitted to man by the larval mite. The mite is found in large numbers on the ears of the field nuce which however do not appear to be suffering from any infection. 976 ETIOLOGY

(1936) The mite borne typhus has also been reported from Sumatra under the title of scrub typhus, and by Chopra (1936) in India where it has been especially studied by Ghosh

Lewthwaite and Savoor (1940) have found that cross protection tests between the organisms of Sumatran inte fever and the tsutsugamush of British Malaya performed on rabbits and monkeys confirm the conclusion that they are identical diseases. Kouwenar also holds this view

Fletcher has also shown that there are 2 forms of muld tropical typhus in the Federated Malay States (1) known as the urban type (W form) which occurs in the towns and spreads among the people who are handling grain while the other form known as serub typhins (K form) occurs in the country especially on plantations and fins a close connection with the



Fig. 220 -- The Redaint links 1 more to the mans (From Rug and 24) Term

clearing and pruning of palm trees. It is the K form that is now regarded as caused by a variant of tsutsugamushi virus. Subsequently it was reported that these two diseases in Malaya could be separated scrologically (Lewthwaite and Savoor, 1937). The W form is now regarded as a form of endemic munic typhus.

The rural typhus of Malaya according to Lewthwaite and Savoor, is not accompanied by a primary sore although in all other features including serological and infection of annuals it is identical with tsutsu gamushi both being transmitted by Trombicula (See page 983) Kouwenaar (1936) in the Sumatran mite fever found a primary ulcer developed at the point of the bite

Delbove (1938) has also described a similar disease to tsutsugamushi in Cambodia and in Indo China

ETIOLOGY AND EPIDEMIOLOGY

Etiology—The work of a number of Japanese investigators has demonstrated the inclustical nature of the disease. Hayashi (1920) reported as the cause a minute rod, ring shaped or spheroid body which when stained with Giernas a stain is demonstrable in the lymphocytes and intradermal inoculation. However on account of cross immunity tests and the case of transmitting the disease both by intra ocular and intra dermal reactions into rabbits and monkeys they concluded that the name of rural typhus should be discarded in favor of tutiusgamush. No distinctive pathological lesions were described except petechal haemor frages in the heart lungs alimentary tract and kidneys. However they observed from histological examination of sections of the brain small perivascular infiltrations more common in the poins and mediula but also present in the cerebellum. The cells surrounding the blood vessels were reported as neuroglia cells and lymphocytes. Rickettsiae were demonstrated in the cells of the blood vessels wall. Thrombus formation was noted in some of the capillaries. Focal lesions were also encountered in the brains of infected guinea pgs.

Rouwensar found 1 23 autop ies of mits bite fa er in Sumatra sim lar lessons. There was enlargement if the spleen congestion of the viscara and of the brain together with lymphad nopathy.

The lessons in the brain were also similar to those found by Lewthwaite and bayo r

From the informat on obtainable it would appear that in tuitisugamush of easi the does not our the wide spread thrombotic leaving of the perpharal blood versile 10 comm als ob erved in typbus fe or though thrombus format in bas been reported in instances in the appliance. Wolbach points out that the p sensor of increases in different o gaze suggests that small blood vessel of the internal o gaze may present less leading to thrombo is

Symptomatology

Incubation Period —In Oda's series of 14 patients whose contacts could be definitely traced the incubation period varied from 7 to 12 days was frequently 8 days and averaged 9 days from the time of the bite to the onset of general symptoms. In most there was a lack of prodromal symptoms.

It should be noted that many persons butten by the mite (uninfected) complain of headche oppression general malaise numbness at the site of the bite anorcua sinvering and even chils and fever. These symptoms subside in a or 1 days and may be caused by the secretions of the mite and not by the disease itself. Such phenomena have been demon strated experimentally by myecting freshly macerated observation into volunteers. The infected mite produces not only a local lesion but necrosis.

The symptoms of the disease frequently observed in different localities coinsist of general malaise headache anoreus insomma with dizziness timutus pains in the joints and epistasis. Chills may occur and more generally constitution. The most supportant anymptom is the tenderness and swelling of lymph nodes near which one may find yellowish brown necrotic plaques of six no overed by small crust. On removing the crusts ulcers are found which indicate the point of the ansect bit. The necrous in the skin and enlargement and tenderness over the adjacent jimph nodes serve to distinguish the condition clinically from other necessital infections except some cases of feiver boutonness. The spleen is commonly

Monkeys and rats may be experimentally infected by blood or tissues from the human cases and also by the bites of mites or inoculation of their crushed hodies

Kawamura and Imagawa (1931) have reported the finding of ricket tsiae in the salivary glands in collections of T okamushi fed upon infected mice Kawamura has confirmed the hereditary transmission of the virus

Rickettia little seamucht has been studied in its ue cultures (Yoshuda 1935) Wolbach (1940) points out that since it does not invade the nuclei of the mammalian cells in tissue cultures as do the nicketisae of the Rocks Mountain spotted fever group it is probable that it does not invade the nuclei of the cells of the vector, an important behavior in classification

In Mala; and Sumatra the disease r reported as transmitted by T adamistic T delinents, and T schiffners. However, I ewithwaite and Savoor (1936) question whether T delinensis is a new species. Neither for nor incls will transmit these diseases but the field can do so under

experimental conditions (Nicolle and Sparrow, 1935)

The reservoirs of the Sunatra mite fever appear to be the house rat May variatis. In the Malayan tropical typhus the reservoir is the common house rat Mus raths. Those who handle hemp vegetables grain wood, hay in the endemic regions are particularly in danger of infection. Most of the patients are agriculturalists.

Angstein (1934) states that in Malay the urban disease (W form) is probably the same as Brili's disease or endemic typhus (fiea borne typhus) while in scrub typhus the actual vector 1 a mile

I athology

No distinctive gross lesions have been reported. Apart from the descriptions of the local uller and the swollen regional glands little that is definite regarding the pathology has been published. The spleen and lymphatic glands have generally been found enlarged and there has been general sysceral congestion.

kitashima and Miyajima (1918) have reported upon the histology of the primary ulcer and the enlarged ly mph nodes as consisting of an inflam matory reaction accompanied by necross. In the lymph nodes there was bbrinous exudate and necross. Similar lessons were noted in infected

monkeys No vascular lesions were described

Kawamura (1930) also described these lessons in the skin in which there was perivascular infiltration composed mostly of mononuclear vesicular cells and lymphocytes without polymorpholeucocytes. In the former and certain (yaiph nodes, proliferative and exidative lessons were found accompanied by necross. No changes in the blood vessels and no thrombi were encountered. In the internal organs miliary necroses are found in the spleen bone marrow and liver. The presence of lessons in the central nervous system are not mentioned.

Lewthwaite and Savoor (1936) have reported upon the pathology of the rural tropical typhus of Malay An unital lesson like that observed in tsutsugamush disease was not found either in man or infected laborator animals, either when the animals were infected by mites or by means of

SYMPTOMS IN DETAIL

The Nervous System -There is marked giddiness and headache at the onset Hyperaesthesia of the body is quite characteristic. There is

often dehrium at night Deafness is frequently noted

The Cutaneous System -A small necrotic ulcer about 1/6 inch (5 cm) in diameter with a dusky red arcola is noted at the site of the bite of the larval mite The healing of the ulcer is delayed well on into convalescence About one week after the onset a dusky macular eruption appears first on the face (cheeks) then going to the chest legs forearms and trunk is not marked on neck arms or thighs. It never becomes petechial. The eruption has been reported on the soft and hard palate and rarely on the buccal mucosa. The eruption may be absent in atypical cases and in second attacks the rash usually does not appear

Fever Course -- The temperature which on the first day or two reaches only 101 to 103 F becomes later on higher and continuous About the tenth day from the appearance of the eruption it begins to fall becoming

remittent and then intermittent The Lymphatic System -Very characteristic is the swelling of the glands proximal to the initial ulcer The connecting lymphatics may be inflamed Later on other glands may show slight swelling and tenderness The spleen is usually enlarged

The Blood -There is no change in the red cells but there is a leucopenia

PROGNOSIS

The mortality rate reported in Japan varies from 15 to 60 per cent the higher rate obtaining for older people After 30 years the mortality rate increases sharply Pregnant women usually abort and die In Sumatra de Langen gives the mortality as only about 4 per cent the disease evi dently being of a much milder nature One attack is said to confer some immumity but reinfection is not uncommon although usually mild Second attacks have been reported within a year of the primary one

DIAGNOSIS

In the differential diagnosis the limited geographical distribution should prevent error and in particular where the initial necrotic ulcer is present with enlargement of the glands draining the region in which it is located there should be little confusion. While in plague there is rarely a primary vesicle or ulcer with enlargement of neighboring glands these glands are matted together and exquisitely tender. Then too the eruption of tsutsugamushi and the early and more stuporous state of plague should differentiate even without the aid of the laboratory

Tsutsugamushi typhus fever and spotted fever have many character istics in common These diseases may be differentiated somewhat by the course of fever and eruption as shown in the following table which illus

trates the symptoms which are more commonly observed

enlarged and the liver usually is not palpable Congestion of the nasal nucous membrane epistans and phary agits together with bronchal symptoms are sometimes present Hyperaemia of the conjunctivae is almost always present

A Typical Case —Usually about 3 days after receiving the bite of the larval mine which may not have been noted by the patient there develop chiliness guidiness and headache, with a rising temperature. In 2 or 3 days from the onset, painful glands are noticed in certain regions, as of the groin avila or neck. From these glands on each often, by following inflamed lymphatics find the small necrotic ulter several mm in diameter which is often located in the armptor or in the region of the genitals. There is a dark red arcola about the ulter, which is only slightly tender. There may be general glandular enlargement following that of the primary swellings. The pulse rate is usually from 50-too notwithstanding the rise of the fever to tog For even 105 F.

The body is decidedly by peraesthetic and the conjunctivae are injected. There is frequently deafness. About the seventh day a macular eruption appears first on the face and then spreads to chest extremities and trunk. The eruption never becomes peterhial. The tongue becomes dry and cracked. There is often at cough. The blood shows a leukopema. The eruption disappears in from seven to ten days and the fever becomes remittent or intermittent and after a few days reaches normal. Parotitis may occur as a complication. A relative immunity follows an attack and in the event of another attack it is less severe.

Pseudo typhoid Fever—In the cases described by Schuffner from Smarta the necrotic ulcer and glandular enlargements were followed by a toneola which reached its maximum on the eighth to tenth day and was most marked on the trunk and flanks. The nervous aymptoms resembled typhoid fever and there was a hymborytosis. DeLangen (1936) points out that the pseudo typhoid as described by Schuffner and later by van Diriel differs from tsutsugamushi fever as seen in Japan in having a much lower death rate and having a lymphocytosis in place of leukopenia and appearing throughout the whole year although more active from June to August. In a few cases in Sumatra however a leukopenia was present

Scharz Boil — A consolvenble number of cases of a durant resumbling instrugenomials were noted by wan lissoon in the German troops on the Russian front. He gave the name behard boil to the discusse after the place of its occurrence in Russia. The discuss was associated with low lying a rampy tracts and occurred during the late summer and autumn months. There was an abrupt moset with chill followed by fever and headache with rather marked's elling of a roup of glands most often of once is sure chaveolar fossa, andla or inguisal region. These glands supraised once is not expected to the place of the supraised after or a weeks. About a week after the onest an engine appeared chiefly on backs or one of the sure in relation with a societie in the summer of the summer

SYMPTOMS IN DETAIL

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trates the symptoms which are more commonly observed

	Fever course	Eruption
Tsulsugamushi	Fever increases each day until reaching maximum about 4th or 5th day I all by lysis after fad ng of eruption	legs forearms and trunk Does not become peterbial
Tabardula Typhus fever Brill s disease	Onset and termination of fever characterized by con iderable abruptness Very atriking mental symptoms	thence going to abdomer
Spatted fever of the Rocky Yountains	Gradual or fairly rapid rise during a week with lysis commencing at end of second week continuing through third week	Petechial tendency May have gangrene of prepute

The Weil Felix reaction is frequently of value in diagnosis. In studing amush disease there is usually a positive aggliutination in moder ately high titer with the strain O'N., while the serum gives a negative reaction with O'N and O'N. 19, this differentiating the disease from typhus and spotted fever. Unfortunately in some of the milder forms of the disease occurring outside of Japan these reactions are less constant and hence of less value. However the negative aggliutination with O'X and O'N 19 is usually the condition and hence of value in excluding true typhus infection. In some atypical cases in which only a low aggliutination in the for O'X 1s found and where there is an absence of doubtful primary lesion and rash and alisence of leuvopena, aminal inoculation and cross immunity tests may be necessary to establish the diagnoss Fever, and often scrotal reactions, are observed by the inoculation of grieve pigs. The inoculation of inst is usually gives inapparent results.

PROPHYLAXIS AND TREATMENT

Prophylazs—In mite infected countries the body should be pretected by proper clothing. For this purpose in Japan a mite proof surhas been devised and should be worn especially by those harvesting hempduring July and August. It has also been augusted that laborers should dust their bodies with a powder consisting, of equal parts of flowers of sulphur and talcum as a repellant for the mixes. Dimethythaliate has been particularly recommended. The larval form of abamiah may be effectively destroyed by spraving the infested ground with petroleum emulsion. Excission or cutefurzation of the area of the bite has been suggested, but it is not clear that this has been of great value. Prophylactic inoculation thas not yet been demonstrated to be of value

Prophylactic modulation has not yet been demonstrated to be of variety

strain of tsutsugamushi fever produced a mild illness in a man followed by immunity to undoubtion with a strongly virulent strain. However obviously this method could not be recommended for general employment. Lewthwate (1939) has been unable to confer any immunity against issusagamush infection in guinea pigs by means of different prophylactics prepared from suspensions of R orientalis sterilized with formol phenol or by other vaccines.

Treatment.—Salvarsan has been found valuele's and drugs are indicated only symptomatically especially to combat the meaning. Hayashi and Mukoyama have recommended the use of immune serum for the treatment of severe cases. Serum therapy is still in the experimental stage.

SCRIB TYPHUS

Struk is plus has extreme military importance because of its prevalence in the Southwest Lacific area and the China Burma India theater

Sapero (1944) reports that seruh typhus has occurred in our armed fonces in New Guines usually in outbreaks which have been in sharph localized areas. The infected areas appear to be Kunna grass meadow and adjacent jun,le martuns. Several pecies and several generic of mites are prevalent in the areas concerned with the outbreaks but to date no one pecies has been definitely incriminated as a vector. It is suspected that certain species of jungle rodents may serve as an animal reservoir for the di-sase but on this point evidence a) or still largely lacking.

Lipman Byron and (a ey have studied ros cases occurring in New Guinea in which there were 68 darby gaining a ca e mortality rate of 9 per cent. In two of the fatal cases there was a clinical diagnosis of large pulmonars, embodi occurring after the acute febrile period of the die ac had passed. The average duration of the febrile, period was 17 days. It wared between 10-27 days.

Physical examination often revealed an exchar representing the site of the bite. In this series 70 per cent, howed this lesion with marked regional adendary By the fifth to the eighth day 85 per cent of the case showed a maculopapular crythematous rath on the thorix or abdomen. The rash lasted eight to twelve daws. Bronchinis developed in about 30 per cent of the cases. The cardiovascular system was also profoundly affected. The Well Felix reaction with Irotus O'L'A was positive in every case by the second week. In crit cally all patients a title of 1: 100 was held to be diagnostic. In the midder cases, the titer ranged from 163 to 1: 1250 by the r6th day. The treatment is symptomatic.

Conbett (ro.4) has studied the pathology in 7 cases of serub typhus and given a brief timical abstract of each curs. An acute diffuse myo-carditis characterized by a permascular and intervitual infiltration with mononiclear cells and occasional neutrophiles and eosinophile, was found in every case. Damage to the myo-cardid libers virued in degree. The sacular endothelium was usually avoilen. In places the arteriolar walls were thick-med and degenerated and he morthage untramural round cell infiltration. In one case a mural thrombus was seen in a small subendocardial vessel. In the lungs at bloady pneumonia was present in three cases and a hemorthagic infact was noted in one mistance. In the livet in several instance, there were areas of focal necrosis. The spleen showed engories

ment and in one instance a thrombosed vessel was seen in the region of an infirst. In the gastro intestinal tract enlargement of the lymphoid follicles was seen in several cases. The kidneys showed congestion in all cases and small four of perivascular round cell infiltration and interstitial hemorrhages were frequently noted. The brain was examined in 4 cases. A constant characteristic was a lesion consisting of perivascular proliferation of glial cells and infiltration with Jimphocy (es. The vessels showed swollen degenerated endothelium and in several there was inframural round cell infiltration with pretross of the infilmal and medial layers. The conditions found correspond will to those described by Lew thwatteand Sax our and Kouwenaar described on page cyp.

Ahlm & Lipshutz (1944) have also reported upon 76 cases of Tsut sugamushi fever in the southwest and have summarized some of the

observations of others

BULLIS FEVER

During the spring and summer of 1942 among soldiers engaged in field exercises at Camp Bullis near Houston Texas a febrile infection was observed in which all the patients had multiple sick bites by Amblyomma americanum shortly before the onset According to Woodland McDowell and Richards (1043) who observed 33 cases the fever lasted from 3 to 13 days The onset was abrupt most of the patients had post orbital headache or occipital headache the fall was by lysis and there was no further rise except in a few instances in which an occasional rise to 99 F was observed. All the patients had enlargement of at least one set of lymphatic glands while general adenopathy was common. The throat was slightly red and injected. In the more severe attacks (10 per cent) a maculo papular rash was seen on the trunk early in the course of the fever it never lasted more than 48 hours and resembled the rash of endemic typhus. There was pronounced leucopenia on the and or 3rd The blood of six patients was tested at the National Institute of Health Laboratory completely negative findings were reported for fevers of the typhus group undulant fever tularremia typhoid and paratyphoid A and B Inoculation of gumea pigs rabbits and chick embryos revealed no causal agent

Livesay and Pollard (10,42) report that gunea pigs inoculated by the intracerbrial route with spinal fluid from patients developed a transient mild fever on the oft day in several cases. In one case a serial passage as successful but there was no apparent increase in virilence. Brain substance from reacting gunea pigs inoculated by the intravenous route into developing chick embryos caused their death within 6 to 0 days and the same result was obtained in 5 serial transfers by the same route.

Guinea pigs inoculated with the blood of patients by the intraperioncal route showed a low grade febrie reaction lasting a days which occurred consistently on the 9th to the 10th day. There was no scrottly reaction but in a cases an aseptic fibrinous peritonitis was observed smears from the epicens and pertonical scrapings from the guinea pigs showed small red stained rods and occord bodies in the cytoplasm and nuclei when stained by Matchasvello technique. Similar results were obtained in specimens from the relarged lymph nodes of two patients and emulsions of such lymph nodes also cuived a febrie reaction: "

pigs About 150 ticks mostly 1 americanum were collected at random in the affected area and tested by gumea pig moculation. One positive result was obtained in which intracerebral inoculation caused a rise of temperature to 106 F for a hours on the oth day By intravenous serological and other tests Rocks Mountain spotted fever typhus fever O fever Chaga's drease equinine encephalomyleitis and lymphocytic corromeningitis were also excluded. It was concluded that Bullis fever was a previously undescribed syndrome apparently caused by Rickettsiae which may be transmitted by an arthropod vector in the Camp Bullis Area

Parker and Steinhaus report that at the U S Public Health Service Rocky Mountain Laborators about 10 000 4 americanum and about 2 500 mites from Camp Bullis were tested for infectious agents The mite tests were negative. However a number of strains all of the same rickettsiae have been recovered from the ticks. Guinea pigs and white mice are susceptible to it The rickettsine cross immunizes with Ricket issue diaporica the agent of American Q fever. It is either identical with it or closely related but the infection caused in guinea pigs differs somewhat being irregular and less marked Further study of the infec tion would seem desirable

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Chapter XXVIII

TRENCH FEVER

SYNONYUS AND DEFINITION

Synonyms —Pyrevia of unknown origin (P U O) Meuse fever, Vol hymian fever shin tever quintan or five day fever

Definition—Trench fever is a specific infectious febrile disease in which the virus is present in the blood and sometimes in the unne, and is commonly transmitted from man to man by the body louse Pediculus himmanis (corpors). It is characterized usually by an enlargement of the spleen and an eruption consisting of small crythematous spots or papiles headache dizziness pain in the legs especially the shins the bod and behind the ejeballs injection of the conjunctions and a sharp rise in temperature to rog or rod? In the majority of the casks the fever or other symptoms assume a relapsing character. No single symptom or characteri tic of the disease yet recognized is pathognomonic. Death practically never occurs.

HISTORY AND GEOGRAPHICAL DISTRIBUTION

History —Trench fever is one of the infectious diseases regarding which our knowledge has been obtained as a result of the World War. It is remarkable that so striking and communicable an affection as trench fever should have been an unrecognized entity prior to that period. For this reason it was suggested that it had been introduced by colonial troops into the armies in northern Europe where it attracted particular attention by its prevalence or again that as the armies in the field were more or less exposed to medieval conditions hence a return to medieval disease is whether in merfectly known might be expected. One can only conjecture as to whether the quintan fever described by Hippocrates. Galen and Razes was the disease known today as trench fever. Chinically it might in earlier years frequently have been mistaken for malaria or European relapsing fever. As there is no specified dagnostic laboratory method known for trench fever even today it is probably often confused with order disease.

As to the suggestion that the disease may have been introduced into Europe by colonial troops it may be said that trench fever does not definitely correspond at least to any of the well recognized eacts forms of fever While resembling dengue in some respects and relapsing fever in others as well as various well recognized exotic fevers there is no autisactory account of the prior ensistence of such a type of fever. Some have thought that the miliary fever reported in France from 1821 to 1855 might have been a type of trench fever since it had no mortality The Endemic of 1015-1018 - During the latter part of 1015 and in

roto the occurrence of a disease characterized by febrile relapses became gradually recognized in some of the armies in northern Europe. It was first referred to in Flanders and France by Graham and Hunt and Rankin McNee Brunt and Renshaw first described it under the name of trench fever Herringham also called particular attention to it and stimu lated its further study. Werner described cases of a similar affection in German or Austrian troops in Volhyma and Poland

McNee Brunt and Renshaw did much to establish the specificity of the disease and were able to demonstrate that the infectious agent was present in the blood and that the disease could be transmitted from man to

man by direct inoculation of the blood

There was much speculation as to the nature of the infectious agent and the method of its spread It was suggested by some to be spread by rats or mice Just as in the case of malaria and yellow fever before the proof of their method of transmission was demonstrated so in trench fever a number of observers had suggested the disease was conveyed by insects Flies mosquitoes fleas and lice were all suggested as being concerned in its transmission

In October and November 1917 the writer being cogm ant of the enormous loss of man power which trench fever was causing in some of the allied armies and of the great danger of its introduction and increase in other armies made a formal offer to attempt to determine definitely and with properly controll d speriments the method of trans mission of the disease which obviously was the most important p oblem in connection with its prevention This offer was accepted and after the necessa y authority had been obtai ed from the American and British military authorities in Ja uary 19 8 and the writer had secured the detail of six other medical officers two n n com missioned officers from the American E ped t onary Forces and one medical officer f om the British Expeditionary Forces to assist in carrying out these investigations as well as a detail of eighty six only ted men from the Unit d States army who had volunteered to submit to the necessary experiments, the work was undertaken

At the same time the British War Office also appointed a commission to study tre ch fever a London with Surgeon General David Bruce as chairman and Major W. Byam

as supervi o of the clinical and experimental work t In the work of each of these two commissions there was close and frie dly coop ra

The British Comm sion carried out its work in London upon civilian olun teers and in well equipped I h ratones while the Americ n Commi s on ca ned out its inve tigat ons in inprovised laboratories: the field. The latter commission howe er had the advantage of securi g your and healthy luntee. I me the United States army for the experiments and a ple tiful sou ce of supply of acute cases of trench fever

Both of these Commissions demonstrated from well controlled experi ments on human volunteers that the infectious agent is present in the

The n cs of the member fith Con ussion that car ed out these s ve t g ! ns were H F S it E L Opic W J Macneal W Bactjer 1 M Papp i m A D Peac ck a d D Rapp 1 in add ton to the urt r

The Her r be s of tl Commission we e A Bacet D Ha y H Pl ime

H French J 1 Ark + tht P M Flet her and A F Hard

986 TRANSMISSION

blood during the disease and that the disease is transmitted by the lou e Pediculus humanus

Practically all of the important knowledge we possess regarding trench fever is to be found in the two reports of these commissions

GEOGRAPHICAL DISTRIBUTION AND PREVALENCE DURING THE WORLD WAR

The disease was observed during the war particularly in troops in Flanders France Poland Galtica Bukovina Italy Salonica Macedonia Mesopotamia and Lgypt Certain areas within these countries were particularly infected. It was one of the largest sources of wastage of man power in the combatant forces. From 1915-1928 it has been est mated that it was the cau e of from one fifth to one third of all cases of illness in the British armies in France, and of shout one fifth of all classes in the German and Austrian armies. It was introduced into the American sector after its method of transmission had been discovered where its wide spread was prevented. The disease evidently found conditions most favorable to its spread among troops in the field heavily infested with lice. It is interesting to note that at the pre-ent time (1940) neither cases of trench fever nor of Weil's disease are being encountered in certain regions in Flanders where they were during the war so common among troops. However several German reports of the occurrence of outbreaks of the disease have been made in 1943.

Ethology —The blood in the active stages has been shown to contain the infectious agent. This was first demonstrated to he the case by McNee Brunt and Renshaw, and later the American Commission confirmed this fact and further demonstrated the fact that the virus is present in the plasma of the blood. It was also shown that the virus is sometimes excreted in the urine in trench fever and that it was possible to infect human beings by the inoculation of a small portion of the unnary sediment.

from trench fever cases

Method of Transmission - The disease is transmitted commonly by the body louse Pediculus humanus corporis hving under practically natural conditions as was first demonstrated in an entirely conclusive manner and hy properly controlled experiments by the American Research Commission In these investigations 103 different human experiments were carried out upon volunteers from the American army in connection with the study of the transmission of the affection. In the first group of experiments in connection vith its transmission by lice twenty six men were exposed to lice that had bitten trench fever cases in the febrile stages of the disease while four other men were exposed for the same or a longer period of time to normal uninfected lice which had only fed upon healthy individuals After a period of over three months in order to show whether the men who had been exposed to the normal live were or were not natu rally immune to trench fever three of them were subsequently exposed by other methods to trench fever infection All of them contracted the disease Of the twenty six men in the first group who were exposed to hee that had fed upon cases of trench fever twenty or seventy six per cent developed this disease On the other hand the two exposed to many

hundred lice newly hatched from eggs laid by lice which had fed on trench fever cases did not contract the disease. Thus no evidence was obtained of hereditary transmission of the virus of trench fever in the louse. In the three instances in which lice taken from the clothing of trench fever cases were employed for indection it wo of the individuals exposed to such lice contracted the disease.

After having shown conclusively by fourteen positive experiments in

After naving shown conclusively by fourteen positive experiments in the first group that the losse transmist be disease living under natural conditions experiments were performed to show whether this insect may transmit the disease by its bite blone when hiving under natural conditions or under unnatural conse in entomological bove and biting through chiffion and when no scarification or scratching of the skin and no crushing of the lice occurred. Five experiments of this nature were performed all of which resulted positively

From other experiments it was shown that practically all virus free control lice become infective about a days after feeding on febrile patients

In eight experiments with volunteers it was shown that trench fever may be produced in an artificial manner by scarifying the arm and rubbing in as in vaccinating against smallpor a small amount of the extrement of lice which had fed upon trench fever cases. The British French Fever Commission first demonstrated this method of infection the excreta being collected from the sixth to the uneteenth day after first feeding upon the patient. In these instances it was found that the incubation period of the disease varied from seven to eliven days.

The Vurus — During the World War very extensive investigations regarding the specific microorganism of trench fever were made and a large variety of organisms both bacterial and protozoal in type were described as the probable causative agent by various investigators working with the hope of discovering the cause and chumaning this dieses. From these different investigations it was evident that the chology of trench

fever had not been entirely definitely determined

As trench fever like typhus fever is transmitted by Pediculus humanus corports and as extracellular Rickettsta have been found in some lice fed on trench fever cases it has seemed to a number of writers a natural assumption that trench fever is also caused by Rickettsia Some observa tions suggest this and it may be true and for obvious reasons it is a temptation to accept it as a fact Nevertheless it must be admitted that this fact has not yet been demonstrated by scientific experiment and the evidence should be reviewed. Rickettsia have never been demonstrated in man in this disease nor have the vascular lesions in the skin so character istic of rickettsial infection heen noted. The trench fever infection has not been transmitted to any animal as is the case with rickettsial diseases Mice rats and guinea pigs inoculated with the infected blood of trench fever first by McNee Brumpt and Renshaw and later by the American Commission have been negative. It is true that Topfer found extra cellular Rickettsia in lice fed on Trench fever cases and in lice fed on cases of Trench nephritis (which was not regarded as an infection) and that 988 ETIOLOGY

Arkwright Bacot and Duncan (1919-1920) found that some of the lice led on trench fever cases showed extracellular Richettina

However, one cannot disregard the experimental sort of Monk and Roch Limo, distort and firmpt. Hindle and the writer which conclusively, demonstrated that Re better were found in normal bee feel on healthy people in a locality, free from trench ever and that such Reckettins were paperately identical as his those found in some Le feel on trench fever cased as well as with those found in some Le feel on trench fever experiments with other discusses and moreover that you have feel for other healthy people produced no discusses.

Sikora in emphasizing that Retefities have not been shown to be the cause of Volkymonn lever found that of no healthy, loosy persons not less than 13 balloost let showing Retefiting. With the contents of such neighbor containing lice guizes pigs were inoculated into the heart and jouing mice subcitisneously but the armshift not expected in the contents of the subcitisneously with the contents of the outen intected lice and later subcitisneously with the contents of the subcitisneously with the contents of the without any indication. Bringer also collected lice without any indication. Bringer also collected for many healthy prisoners and found them heavily indicated with Richet is 11st fed severity of these upon himself and remained healthy. Barde who fell lice on largelf intervals for a long petrod developed a fever 1 hen in Poland and it n as suggested that he had Tench fever.

Wolbach suggested that there may be evidence in this that Puckelling cause trench fever because of at lice that were fed upon Bacot when he had this fever in I pland, in developed entracellular (never intracellular) Rickettria But it must be kept in mind that it has been conclusively demonstrated by at least six investigators mentioned above that lice fed on healthy people or those suffering from other fevers, may show these extracellular Rickelling and that diagnosis of a single case of trench fever is often very difficult and that there is no proof that trench fever was prevalent in Poland at that time. However as typhus was prevalent at the time in Poland and no trench fever was reported as being present in the region it has been suggested that some of the lice which had fed upon Bacot were injected with a few Rickelling proug ski of typhus as well as with the extracellular Ricketting which occur not uncommonly in normal lice It would be quite impossible to exclude the presence of a very mild infection of the louse with R provacks by a microscopical eramination of the louse alone Bacot is supposed to have fater died of typhus any case to attempt to establish the etiology of a disease upon a single doubtful case is dangerous and if the organism found in the lice fed upon Bacot were believed to be other than R broug eki it is unfortunate no study was made of them Wolbach admits that the ouestion of decid ing the specificity of Rickettsia for trench fever is a most difficult one also whether Re bettern bedients is the cause of Trench fever Zinsser (1040) states that he omits trench fever in his discussion of the rickettsial diseases of man as it stands somewhat apart in chinical characteristics and because he thinks we possess too little experimental knowledge of the responsible urus to define its preuse relationship Finkerton (1936) points out that it is theoretically possible to establish strong presumptive evidence of trench fever by feeding carefully controlled lice on patients to see if they acquire nekettsiae However rickettsiae sometimes develop in lice fed on normal individuals. On the other hand lice containing R pediculi or R quintana fed on healthy individuals have not produced Trench fever It has been suggested that R pedicule is similar in the louse to R melophage in the intestine of the sheep ked both being non pathogenic for man

Trench fever is a relapsing fever and is not a fatal disease. In this latter respect and in some other features it resembles dengue fever though unfavorable sequelae sometimes develop in trench fever. The experimental evidence has shown that dengue fever is due to a filtrable virus (Ashbum Craig 1907) (Silte Soule 1925-1928) and others. While the virus of trench fever is not filtrable as it occurs in the blood several experiments have indicated that this virus in 4 suitable medium as unne may occasionally pass through coarser filters even though such passage is unusual (American Trench Fever Commussion 1918 Bradford Bashford and Wilson 1910)

In a study of dengue Siler and Sellards (19 8) found in about half of the mosquitoes (Aedes aegraph) fed upon patients masses of Rickettsto in the lumen of the hind gut and in smaller numbers lying within the epi thelial cells.

If it should later be proved that trench fever is caused by extracellular orgain ms in the intestines of hee as Rickellus petient it will be neces sary to modify the definition of the geams Rickellus which organishly referred to intricellular microorgansms. All of the known pathogenic spaces of Rickellus occur intracellularly.

Mo ug $\{g_i\}$ described an interesting spidence among propile employed in feeding. I bonst y rearred hie used for the purpose of propared Wagi avec as equant classical typhus of the purpose of the property of the feeding typhus of the feeding of the feeding

Somewhat similar infections were reported in Rus in by lakimoff (1926) in Japa by Ogata (1935) a d France and Spa n by Schapino (1939) The relationship of these oull resks t e de mit typhus has n t been clarified.

Pathology

The disease constitutes a mild specific form of septicaemia and the symptoms of it are obviously due to the action of the towns of the virus which circulate in the blood and is excreted at least partially in the urine The virus may ometimes persist in the circulating blood for as long a time as 300 days from the beginning of the disease as was demonstrated by the British Commission In chrome cases the towns of the virus give rise to a more or less cachectic condition As there are no records of autopsies in trench fever cases the disease being practically never fital no histological investigations have been carried out except in connection with the maculae of the skin Schminke has reported that the corium of the trench fever macule is hyp remic and oedematous and that there is a perivascular lymphocytic infiltration with a variable number of polymorphoniclear leucocytes. The skin lesions differ from those seen in typhus fever in that there is no necrosis of the endothelial cells of the vessel wall and no hvaline thrombosis It has been suggested that the segmental area of cutaneous hyperesthesia may arise from inflammatory changes in the dorsal nerve roots

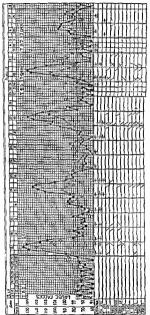
SYMI TOMATOLOGY

Incubation — the incubation period of the disease in nature probably varies between ten to thirty days, though if the infection is acquired from a very large amount of the virus, this period may be somewhat shorter. In the cases in which the disease was produced by artificial methods of infection, such as the intravenous impection of blood or one of its constituent elements or by scarifying the skin and rubbing in the virus either in the lowse excrement or in the urusary sediment the incubation has usually varied from five to twenty days and with five living under practically normal conditions from fourteen to thirty days. During the new bation period the patients sometimes show prodromal symptoms, shortly before the onset of the attack of fever consisting of malaise headache and pains in other parts of the body.

Chinical Features -The most characteristic chinical features of trench fever are the sudden onset accompanied by headache dizzmess, pain in the legs especially the shins, the back and behind the eveballs particu larly when moved, nystagmus on turning the eyes completely sideways injection of the conjunctivae and a sharp rise of temperature to 101 or 104°F The fever in over one half of the cases subsequently assumes a relapsing character Enlargement of the spicen and the appearance of small erythematous spots or papules occur in from seventy to eighty per cent of the cases The erythematous spots are observed particularly over the chest back and abdomen. They are usually not raised above the surface of the skin, are pink in color disappear on pressure and generally measure about two to four mm, although sometimes they may measure from four to six mm in diameter. Occasionally the rash is distinctly papular in character. In number the spots vary from several to one or two hundred They often disappear in less than twenty four hours after their appearance and they may occur as early in the fever as on the second or third day or be first observed just prior to or during a relapse no one of these symptoms given above can be regarded as characteristic or constant, the presence of several or all of them usually serves to make an accurate diagnosis of trench fever during outbreaks

The unne often shows a trace of albumin but evidence of true nephritis is not present in the uncompleated disease. In a small percentage of the cases frequent desire of meturition is complained of and Byam has shown that polyuria is common. The leucocyte count is very variable. There is frequently a leucocytess and the leucocytes may rise at the time of the relapie. In other cases however the count may be normal or there may be a leukopenia. It has been suggested that in patients with persistent pain in the shims a steady high count probably indicates a continuation of the infection.

The fever does not always follow a definite type but may consist of first, a short attack lasting for about a week with sometimes but not always after a few days a single short use, second a more prolonged initial fever sometimes lasting for six or even weeks with relapses not distinctly



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matked, and third a more regularly relapsing lever with more or less definite normal intervals lasting from five to seven days. Many van ations in these types of fever are seen and in some of the patients there may be a long fever lasting from forty to sixty or more days with only very slight remissions.

It has been shown by the experimental transmission of a strain of trench fever virus through several generations in man, either by means of the direct inoculation of the infected blood or through the agency of infected lice that all these main types of fever are common in this disease and moreover that the type of fever which appears in an innoculated case does not necessarily conform to the type observed in the original patient from which infected blood was taken

The number of relapses varies greatly, from three to five periods are common and some have as many as six or seven relap es. Several of our patients who had been entirely free from fever for from six to seven weeks or longer developed typical relapses. In these cases reinfection could be definitely evcluded. In some of the cases at the time of the relapse the temperature may remain normal but a marked increase of the pulse occurs and other symptoms of the disease appear. Occasionally relapses perist as late as a year or more after the original attack.

Tachy cardia and the condition known as DAH (disordered action of the heart) of soldiers have been described as frequent complications or sequelae particularly in cases of the disease occurring in soldiers attacked while performing heavy military duty or in those returning, to such duty before completely well Carmati Jones has found that among roc cases of disordered action of the heart taken at random and serious enough to reach a heart center two out of three wite due to trench fever alone and eight out of nine were due to this indication at least in part. In a group of patients Swift noted the position of the apex impulse from day to day and on several occasions observed the shifting of the apex impulse from well within the nipple line to an inch or more beyond it. Also the area of cardiac dulharses had apparantly increased in width. Concomitant with this change there had been a distinct increase in pulse rate. Whether these signs indicate an actival change in the size of the heart or not is questionable but at least they indicate a distinct alteration in the condition of the heart. Swift has made a careful study of the symptoms.

Occasionally a picture somewhat resembling paroxysmal tachycardia is seen during the course of trench fever. Precordial pain and hyper eithean are not infrequently observed. Accompanying these symptoms and signs directly referable to the heart, there is at times dispinose even with the patient in bed. It is also not an infrequent symptom when the patient is up and about. However, as these symptoms and signs are also found with certain other infections, they cannot be regarded as peculiar to trench fever.

Areas of tenderness are frequently associated with the pains in the head, legs and back already referred to and may involve skin muscles tendons, bones or joint cartilages although the nerve trunks themselves

TERNCH PELES

do not appear to be involved The area of skin found by the British Com mission to be most by peralgesic was that ruoning from knee to ankle along the outer border of the tibia Byam and Carmait Jones found that the areas of skin tenderness seem to correspond to the cighth cervical first and seventh dorsal and the first to fifth lumbar segments of the cord whole of these segmental areas were involved in comparatively few cases those most commonly involved being the lower segments of the lumbar Sundell showed that areas of analgesia might be detected in some of the more prolonged infections the loss of sensibility varying in degree from a mere blunting of sensation to complete analgesia. The most common situations for this phenomenon were the outer surface of the calf the infrapatella the scapula and deltoid regions With reference to these pains and areas of tenderness it is interesting to refer to the cases in the later stages of the disease described by Rudolph and Soltau under the term of trench fever cachezia. Soltau found that not less than seventy per cent of ca es diagnosed in the British army as myalgia were really suffering from trench fever Lloyd also describes subacute cases of trench fever diag nosed as rheumatism myalgia or neuritis

Chrome Cases — The British Commission found that in a large proportion of the cases of trench fiver misalided to England there is a tend ency to advance through a subacute towards a chrome condition with symptoms of disorganized action of the beart and in some cases symptoms of neuratheria. The symptoms met with in these cases were summarized in the order of their importance as follows exhaustion priddiness and fainting headache breatblessness on exertion pain stritability lissified sweating coldiness of the extremites palpitation and cardiac irregularity fewer. The majority of the chronic cases presented all of the above symptoms. By symptoms By symptoms By symptoms when consideration and cardiact which points

to a specific action on the vagus in such cases

DIFFERENTIAL DIAGNOSIS

During epidemics typical cases are usually readily diagnosed from the symptomatology outlined above

While there is no specific laboratory method of diagnosis for trench lever laboratory examinations are often of assistance in differentiating this disease from other infections such as malana. European relapsing lever tick fever seven day fever and Weel adsease without jaundice. Here it may be merely stated that neither spinochaete nor the Lepispius exterhelementagica has ever been encountered in undoubted trench fever cases that the general character of the disease and particularly the relaps ing character of the fever and the nature of the rash are quite different from what has been observed in typhus. From typhoid and paratyphoid fever it may be distinguished by the absocie from the blood stools and unne of trench fever cases of organisms of the entene group. Marins believes that the atropin test is of value in differentiating trench fever from the entene group since the tonus of trench fever stimulate while those of entent depress the nervous system (see Typhoid fever p rafio).

994 TREATMENT

The absence of marked catarrhal symptoms usually (though not always) serves particularly to differentiate the disease from influenza while the character of the rash and the differential leucocyte count serve to distinguish trench fever in the early stages of the disease from dengue fever In epidemic jaundice not only the presence of the Leptospira ictero hemorrhagica but the nephritis, and usually the jaundice serve to dis tinguish this disease from trench fever Pain in the muscles of the neck in trench fever may at times be so severe as to resemble the neck pains of meningitis and the abdominal pain may simulate that of appendicitis so that cases of this disease have been operated upon for appendicitis by mistake. However, the abdominal pain of trench fever is elicited by superficial palpation rather than by deep firm pressure and as a rule, there is no confusion between these two conditions. Undulant fever obviously may be differentiated from trench fever by the detection of the We recovers melt enses in the blood or by the agglutinating reaction of the serum with this organism

PROGNOSIS

The importance of the disea e has particularly depended upon its wide prevalence heart complications and great loss of service caused by it during the war Generally the prognosis in properly treated cases is good and the disease is practically never fatal. It has been estimated that of men in good health at the time when afflicted with the acute disease, about 85 per cent were ready for return to duty in two months from the time of onset However this statement does not apply to the subacute or chronic cases and the occurrence of subsequent relanses in some of the 8¢ per cent of recovered acute cases cannot be excluded Of 236 advanced cases of the disease treated at Hampstead England giving an average disability of 4 5 months only 6 2 per cent left the hospital free from symptoms while 7 2 per cent were returned to civil life as permanently unfit. Of those discharged from the hospital after o months to per cent had still shown greater or less evidence of the persistence of the disease during the time since their discharge. In relation to promosis the immediate placing of the national at rest in bed at the time of onset and during all active symptoms of the disease is important. In the subacute and chronic stages a steady gain in weight is said to constitute the most reliable guide to a favorable prognosis Men below 35 years of age are more likely to entirely recover in a shorter period of time than men above that age

TREATLENT

The treatment should be symptomatic For the pain aspirin is usually satisfactory but in some cases codeine may be necessary to control severe

Up to the present time no sperific remedy for the disease has been found Sweet and Witner, and Richter have reported favorable results from the intravenous injection of 10 cc of a 1 per cent solution of collargol but these observations have not been further confirmed The British

Commission also employed intravenously a large number of drugs such as acriflavine galji collosol argentum iodine antimony sulphur manganese palladium colloidal rhodium intramine kharsivan eusol trypan red tartar emetic and disodoluargol but without favorable results

Swift has emphasized that as long as two or three of the positive signs of the disease persist one should regard the infection as still active. The patient should not be allowed to get up and be about until it is evident that the infection has been entirely overcome. As a rule it is advisable not to allow the patients up until they are well prist the time of an anticipated relapse. The time which the patient is allowed to be up should be progressive beginning with a few hours at June. If during this increase of exercise there is unusual tachy cardia or return of any of the symptoms the time of sitting up should not be increased and if these symptoms per sat the patient should be returned to bed. After the patient has been allowed to be up all day without unfavorable symptoms. he should be placed on a course of graded physical exercise. The striking feature of trench fever is its tendency to relapses and during these recurrent relapses the patient should always be kept in bed.

The treatment of the chronic disease consists briefly in attempting to improve the general health and hygienic conditions of the individual with particular attention to rest exercise duet and chimatic conditions

PROPHYLAXIS

Prevention of the disease is especially dependent upon efficient delousing. The destruction of the virus on underclothing contaminated by louse excreta is also of great importance.

Exceedingly great care should be taken to completely disinfect all patients as soon as practicable and particularly upon their entering the Patients on entrance should be carefully bathed and subse quently sponged with alcohol with the object of removing the virus from the skin Since both varieties of pediculus humanus P corporis and P capitis may convey the disease careful disinfestation of the hair should be carried out. It mu t be borne in mind that while a temperature of 55 C for 30 minutes destroys the louse P humanus and its ova such a temperature doe not suffice to destroy the virus of trench fever which may be present upon the underclothing of trench fever patients. For the destruction of the virus of trench fever a temperature of 70 C of moist heat is sometimes necessary. The clothing of patients upon entrance should be removed and both clothing and blankets whether or not lice or ova are found upon them should be carefully sterilized by moist heat at a temperature not below 70 C for 20 minutes since it is possible for the virus to be still present on the clothing. In institutions autoclaving is most satisfactory It should be borne in mind that a man with trench fever may be entirely free from lice at the time that he develops symptoms of the disease

Those handling the sick and their discarded garments should take special precautions to avoid becoming infested with lice. Louse proof 996 PROPHYLAXIS

overalls and subber gloves are desirable for attendants. It has been shown that the virus of trench fever in excreta of lice may retain its virulence for at least four months. Bed linen before washing may be immersed in a 2 per cent lysof or cresof solution for 20 minutes which destroys the virus.

Trench fever patients should at all times be carefully protected from louse infestation and inspection of them for lice should be made daily since it has been shown that sometimes even as late as the gooth day of disease a patient's blood may remain infective and be capable of infecting five. The patients should be treated in separate ward.

As the urine may contain the virus and be infective it should be stenlized during the active stages of the disease. Infection with the virus may occur through the comunctiva and o i milligram of infective flows excreta has produced trench fever when inoculated subcutaneously infection probably does not take place by the mouth or by inhalation Sputum cups should be provided for patients and as the sputum may be infective it should also if present be sternlized.

The immunity in relation to the disease is variable and one attack does not neces arily protect. The British Commission showed experimentally that re infection was possible in two instances on the 132nd and 198th day after onset.

An eradication of lice results in an eradication of the disease

TODEADOR

References to Trench fever lave been few in the literature of the past several years and obviously no scrious or extensive outbreak had occurred up to 1942. However if the extracellular organism found so commonly in the intestine of hee (R pedicul) was pathogenic for man obviously such a human infection would be very common

Pechtel (1940) reports a case in Poland in which there was an irregular fever of relapsing type with a periodicity varying between 3-5 days. The case was described as one of Woldynian—Five day fever. The symptoms had persisted for two months before the patient entered the hospital After admission there were 5 other spells of fever. The serum agglutinated Proteus \$\(\lambda\) to \$u\$ to \$u\$ title of \$i\$—\$to. Sullapy inthe treatment was started two days after the last parotysm of fever. \$i\$ grains being given in \$i\$ days its reported that the \$i\$, improving yielded promptly and there was no return of the fever. The sullonamides have been shown to be ineffective in true Rickett sal infections.

I ena Yanez has treated 8 ca es of I've day fever during the Spanish Civil War by means of tartat mente: The does were from 8 to 14 cc of a 1% solution given intravenously each day for 7 days and if necessary repeated after an interval of a week Diagnosis was made from the typical temperature curves in 2 a single course of the drug sufficed for cure. In the third there was a slight recrudescence which yielded to a second course.

Werner (1940) has reported upon R quintons in lice in Funftageneber in Germany in the last world war In 1940 writing from Buenos Aires

he stated that Ogata-has succeeded in cultivating R quinland in the testicles of guinea pigs and has used it in the treatment of cases of cerebral syphilis

Since February 1942 a number of outbreaks have been reported in the German armies on the eastern front Bernsdorf states that beginning in February 104 trench fever which had been regarded as a potential threat only then suddenly became a serious problem for the medical men Hospital services were greatly embarrassed by the large number of cases and many of the patients were unit for duty for as long as two to three months Early cases were mistal en for anomalous typhus fever After February its nature began to be recognized from the characteristic clinical features and the relapsing type of fever. The Weil Felix reaction was stated to be negative in trench fever and he thought rickettsize are not likely to cause a disease with such pronounced tendency to recurrence No satisfactory treatment was found. Some to other reports of out breaks have been made by German doctors during 1942 and 1943 Among these are those of Reimer, who observed or cases in the summer of 1042 No agglutination or precipitm tests were discovered as aids in the diagno sis which was based on the symptoms and the relapsing type of fever kerger reports more than 150 cases in Germany (locality not given) The diagnosis was made from clinical symptoms Jacobi reported undoubted cases from a hospital in the east the diagnosis being made from clinical symptoms in which there were relapses of the 5 day type amidon gave relief from pain in only o cases and it did not set m to have any curative action Sulfapyridine was not of value in curing the disease Sylla observed 200 cases He felt there was no doubt about the method of transmission by the louse but he did not feel certain about the causal organism Typi, al symptoms with a usually fleeting rash were noted and the duration was from r to 6 weeks Weil Felix reaction of plus or minus I to 100 were not uncommon Widal titres of I oo were not uncommon Treatment on the whole was unsatisfactory with sulfa pyridine but neographenamine and atabrine seemed to be helpful in the early stages Marie (1043) gives no information of the occurrence of the disease in France but refers to the recent outbreaks of the German army on the eastern front in Poland and Russia and points out that no diagnostic laboratory test has been discovered

Ameth (1942) in referring to the outbreaks in Poland Russia kumania Itali France and Belgium says that Aergef found by the end of the second week there was a leukocytosis with a pronounced Ameth deviation of the neutrophiles to the left. Durin, the fever free periods the leukocytosis was less pronounced but the deviation to the left was still present. Neutrophilic myelogy tes appeared and there was a great increase in the number of the large monounclears and large lymphocytes. He thinks a qualitative count should be made of the hymphocytes and mono cytes and that a more or less pronounced increase in both e pecially of the larger forms is of assistance in diagnosis. Borman (1943) has reported an epidemic among German solders in North Russia and suggests that the Desirabia fever present in rays might have been trench fever present in rays mught have been trench fever present in rays mught have been trench fever.

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Chapter XXIX

VERRUGA PERUANA AND OROYA FEVER

(Enfermedad de Carrion, Bartonellosis)

In Peru for many years Oroya fever and Veruga peruana have been regarded as different clinical manifestations of the same disease but there has been considerable difficulty in the demonstration of this fact from scientific data and it is only comparatively recently (from such data) that this has been accomplished

According to the generally accepted opinion for many years the disease verruga peruana in the severe form begins with an initial stage known as the fiebre grate de Carrion which is characterized by a fever which lasts from 15 to 30 days profound anaemia prostration and a high mortality If the patient does not die in this stage the fever begins to abate and the erup tive or verruga stage commences. If the eruption is generalized and abundant then it is stated that the patient is sure to recover. In the chronic or mild form of the disease which is said to comprise the great proportion of the cases there is moderate fever of intermittent or remittent character and pains in the joints are common more or less anaemia is The eruption is said to be the culminating feature in both forms and it appears under various types which according to the special charac teristics they reveal are termed miliary nodular OF. The nodular form or verruga peruana is evidently very rarely a fatal disease when uncomplicated with other infections

Historical Review—From remote historical times the inhabitants of Feru are said to have suffered severely from an obscure disease charac tenzed by fever anaemia and a nodular or verucous eruption upon the sin. Over four centuries ago during the reign of the Inca. Husyna Capac thousands of lives were swept away supposedly from this malady and in the history of the conquest of Peru by Zarate published in 1545 it is stated that the disease is more destructive than smallpor and almost as disastrous as the plague itself. Perhaps it at this time was sometimes confused with smallpor although smallpor is mentioned separately Later this author mentions that the Portuguese sofders were afflicted by boils or warts of a very mulgiant kind and that not a single person in the army escaped them. De la Vega also relates that during the 16th century a quarter of the imading army of Peru under Transcso Pizarro perished from this disease. It was also referred to in Prescott s. Conquest of Peru.

In 1870 a severe outbreak of fever took place among the workmen building the Central Railway between Lima and Oroya and it is estimated 998 ETIOLOGY

that at least 7000 individuals died during the epidemic. At this time, the complaint received the name of "Oroya fever—although it appears that it was not contracted in the town of Oroya itself but lower down on the railway many of the patients being brought to Oroya, where they died Bourse reported that all of the engineers superintending the building of the Trans Andean Railway contracted verruga and that half of them died it to 40 a saltors who had deserted from a British ship and gone to work on the railway, 30 died of the disease in the course of 7 or 8 months In 1906 out of a force of 1000 men employed in tunnel work for the Central Railway, 200 are known to have died of the disease. It appeared to be only necessary for the workmen to spend a single night in the infected districts in order to contract the malady

Previous to r88; there ensued much discussion as to whether Orgafever and vertuga peruana were related to one another or whether the
latter was a distinct disease. On August 27 1885, Daniel Carnon a
medical student in Lima, and a native of Cetro de Pasco Peru (a town
situated in the mountains far above the localities in which the disease
abounds) attempted to solve this problem by vaccinating both his arms
with blood from a vertuga nodule. It is related that 21-23 days later
he began to suffer from Orova fever from which he died 16 days later, or
on October 5. From this experiment the conclusion was drawn by Peru vian
physicians that vertuga and Oroya fever were only different stages
of the same disease and this is the opinion which has been held generally
by them since this time. In honor of Carrion's attempt to throw light
on the question the febrile condition which has been regarded as the first
stage of the malady, is now generally, known in Peru a's fiber de Carrion

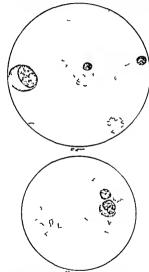
In 1898 the monograph of Ernesto Odriozola appeared which con stituted the most excellent and most comprehensive account of the

disease which had been written up to that time

Especially important contributions have been made in Peru in recent years many with bibliographies by Battistian Rebagliati Excomed Mackeleane Coronado Her celles Sr and Jr. Weiss Maldonado Monge Ortardo and others. Space prevents a review of these publications in the present atticle.

Etiology—Very conflicting opinions have been held by many authors regarding the etiology of the disease and the unity of the two conditions. In 1905 Barton described in the red blood cells of two persons sick with severe malagnant fever elements similar wa morphology to bacilla. In 1900 he noted the presence of these elements in stained blood specimens in 14 additional cases and expressed the belief that they were protozoa and probably the specific agent of the infection. In 1909 Gastiaburu and Rebagliati observed the bodies described by Barton and stated that they were probably protozoa and might be regarded as the pathogene organism in Carrions disease. However later a large number of writers regarded these bodies as products of cell degeneration or were doubtful regarding their etiological significance (Woodcock 1921 Bassett Banth 1909 Wen 1926).

in detail these organisms and created the genus Bartonella for them and named the organism Bartonella bacilliforms in honor of Dr. Barton



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Am ri n E pedit on R port)

Bartontila bacilliformis was also discovered and illustrated in large numbers in the swollen endothelial cells especially of the lymphatic glands the spleen and liver of cases which had died in the febrile stages

Attempts

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that at least 7000 individuals died during the epidemic. At this time, the complaint received the name of Oroya feer; although it appears that it was not contracted in the town of Oroya itself but lower down on the railway, many of the patients being brought to Oroya, where they died Bourse reported that all of the engineers superintending the building of the Trans Andean Railway contracted verruga, and that half of them died it to 64 os allors who had deserted from a British ship and gone to work on the railway, so died of the disease in the course of 7 or 8 months in 1906 out of a force of 2000 men employed in tunnel work for the Central I allway 200 are known to have died of the disease. It appeared to be only necessar; for the worker en o spend a single night in the infected districts in order to contract the malady.

Previous to 1885 there ensued much discussion as to whether Orova fever and virruga peruana were related to one another, or whether the latter was a distinct disease. On August 27 1885 Damel Carnon a medical student in Lima and a native of Cerro de Pasco Peru (a town struated in the mountains far above the localities in which the disease abounds) attempted to solve this problem by vaccinating both his arms with blood from a verruga nodule. It is related that z=z, days later he began to suffer from Oroya fever from which he died 16 days later on October 5. From this experiment, the conclusion was drawn by Peru vian physicians that verruga and Oroya fever were only different stages of the same disease and this is the opinion which has been held generally by them since this time. In honor of Carnons attempt to throw light on the question the febrile condition which has been regarded as the list stage of the mailedy, is now generally known in Peru as febre de Carron

In 1898 the monograph of Ernesto Odriozola appeared which con stituted the most excellent and most comprehensive account of the disease which had been written up to that time

Especially important contributions have been made in Peri in revent years rangy with bibliographies by Battistini Rebagliati Es omel Mackehenic Cornado Hercelles Sr and Jr. Weiss Maldonado Monge Ortardo and others. Space prevents a review of the e-publications in the present article.

Etiology —Very conflicting opinions have been held by many authors reading the eutology of the di ease and the unity of the two conditions for 1905 Barton described in the red Bood cells of two persons sick with severe radigiant fever elements similar in morphology to bacili In 1909 he noted the presence of these elements in stanced blood specimers in 4 additional cases and expressed the belief that they were protozo and probably the specific agent of the infection. In 1900 Gastaburu and Rebagliati observed the bodies described by Barton and stated that they were probably protozo and might be regarded as the pathogene organism in Carton's disease. However later a large number of waters regarded these bodies as products of cell degeneration or were doubtful regarding their etiological significance (Woodcock 1921 Bassett Smith 1909 Wen 1909 1976)—1775 Tible Harvard Commission observed and described

bacilisforms from hoth the febrile anaemic or Oroya fever stage of the disease and the verruga stage and the reproduction of the characteristic lesions of the disease by such culture an assumption of this nature upon scientific grounds would have been unjustified

However two patients with both anaemia and Bartonella bacillyaemis in the blood and verrugas also present upon the skin were observed but these were presumed to be concommitant infections especially since as in a fatal case of Oroja fever there were no manifestations of a verrucous eruption either during life or at the autops;

Extensive experiments in animal inoculation also conclusively demon strated that vertuga was not caused by a spirochaete or other micro organism of that nature and was not related to the spirochaetal infection known is yaws in which a granulomatous eruption upon the skin also occurs

In 1936 the most valuable work regarding the etology of the affection was performed by Noguchi at the laboratories of the Rockeeller Institute in New York (fir t in connection with Battistia of Peru). Noguchi by this time had greatly improved his mecham for the cultivation of Leptorpura and protozoa and carried on studies upon the cultivation of Battonella bacillyforms; in New York City cultures having been prepared from firsh cutrated blood taken from a case of Oroya fever and sent to him in New York. Although bacterial contaminations occurred in the original culture these during the journey renewed attempts at cultivation finally yielded a pure culture of Battonella bacilliforms; on Leptospyra media.

Four Meacus rheurs monkeys moculated with culture's intradermally into the eyebrow and at the same time intravenously developed at the point of the intradermal inoculation nodules rich in cellular elements and capillary formation. The animals also developed a remittent type of fever Barinella bacaliformis was found in the red blood copyusles of these animals in small numbers and this organism was obtained again from the blood of such monkeys through Culture. However inoculation of the citrated human blood directly into rhesis monkeys was without result.

Mayer and Kikuth (1927) made further studies upon a patient with verriga who arrived in Hamburg. In spherection of monhes they produced nodules by the inoculation of human verriga lesions and in two of these aimsals there occurred severe maximum and fever and Rationalla in the blood. The direct moculation of blood containing Rationalla or of a papule junce always resulted negatively. However following Noguch is technique they failed to obtain cultures except in one instance and then only for a scoond generation and they suggest that the cultivation of the strains may vary. Kikuth (1931) after Noguchi is lamented death received a culture from the Rockfeller Institute but in none of the monkeys which be inoculated with this culture droft Oroya fever develop even after removal of the appleen. However cultures of Barbinella locality formis were obtained from verrigas which had been produced in monkeys by the monculation of the cultures.

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were made to cultivate this organism on the available bacteriological media of that period but these attempts were unsuccessful. However, monkeys were successfully moculated with material from human vertiga nodules and these characteristic nodules were reproduced through a long series of these animals. On the other hand, a monkey inoculated intravenously with blood from two human cases of Oroya fever with anaemia containing large numbers of Barborella bacilliforms in the red cell did not develop any vertigas nor were there lessons found in them. All



Fir 223 -B rionello bacili formis in endothel al cells of lymphat c gla d (Harvard South American Papedition)

subsequent experiments of this nature with healthy monkeys have like wise failed

Also a man who volunteered was moculated cutaneously with a human verruga nodule und did not develop fever and annerms or Bartonella baciliforms; in the blood but only a local veruga leson developed exactly as occurs in monkeys. The results of such experimental work obviously did not demonstrate or perms the assumption upon a scientific basis that the pithological processes involved in the febrile annerma or Oroya. Ever stage and the verruga stage of the disease were identical. Nor did the histological study with the technique employed at that time of pathological material from Oroya Ever or verruga permit of such a conclusion. Indeed without the successful cultivation of Bartonella.

agar has also been employed. On all these media Burtonella grows very scantily and frequently unsatisfactorily

liminez and Buddingh (1040) have obtained a more actisfactory growth and shown the behavior of B bac Il formis in developing chick embryo More recently Ceiman (1941) has described a liquid tryptone serum medium contai ing ascorbic acid gluta thione solution and has prepared both semi solid and solid mediums. On such media relatively rapid and luxuriant growth of B bacill formes has been obtained in comparison with the results on the older types of media

Lawkowicz (1018) reported that he had cultivated Bartonello m s on Noguchi s medium from the blood of rats. The serum of rabbits which had been inoculated with cultures of Bartonella muris ga e po itive Weil Fel x reactions with Proteus O \ 10 and O \ k and also agriptinated emploies of R skell is proug sky. Several other

invests ators have failed to cultivate Be torella murse

Thus Kessler (1011) has been u able to cultivate B muris by inoculating infected blood directly into the yolk are into the fertile hene egg. He howe er has shown that B mu secan he preserved for at least to weeks when the infected defibrinated got blood s rapidly frozen in a mixture of dry ice and alcohol and then preserved in dry ice

Howe (1942) has prepared culturee on German e media and hy repeated intravenoue injections of the living cultures into rabbits obtained a ctrongly agglutinating cerum The eera of s immunized a mais gave positive reactions in titers of He then obtained the eera from 6 patiente in various stagee of hartonellosis and found that their sera agglutinated the organism, however at much lower titere ranging from I to to I So. He ne ertheless regarded these reactio e as significent because 13 control eera from healthy persone showed no aggluturation of B bossilisors as Th 6 Positive sera of the human cases were also tested against Proteus O \ 10 O \ K and O X 2 Some of these eera agglut nated all 3 of these organisme to come e tent 3 receted in t ters of at least a 64 nd a to O X 19 to O X hand 3 to O X He d ew no conclusions from the e eactions. Highly immunized guinea pige ga e entirely negeti e eaction to all of these Protene ganisms (See ale p ge or)

Classification. - There have been several yields red not be classification of Ba I in The genus Ba to Il was created in 10 3 by Tyzzer Sellards end the writer in connection with the study in Peru of the causative microorganism of Oroya feve and verruge peruana while the term R cheffs a was fi st applied in 1916 hy Pocha Lima to the cellula anclusions on erved in the inte times of lice which hed fed on natio is with typhus fe e Gradually on knowledge regarding these two types of m c of ganisms her heen extended Some ea ler studies suggested that both might be clessified in a group inte med ate herween the protozoa and bacteria Von Prowazek formerly thought that the Rickettisa were probably closely related to the protozoa How closely either type is rel ted to hacteria is still not ent ely clear but there has been much evi dence which has made it appe and stable to separate both from the titue bacte in on the one hand and from the filtrable viruses on the other. It his been generally agreed that bartonellae are not filtrable and only a few of the mo e m nute rickettsine hav been eported to pass through po cela n filters

The hartonellae and the rickettsiae show certain resemblances fr in a morphological standpoint. Both are minute o pleom, ph.c. n.cha acter and they are Gram neg. t ve and in the human b dy more characteristically intracellular in patu e Ho e er there is a cl se ass c tion between the ed blo d co pu cl s and Bartonella and this s n t the case with any Rick time. Moreover Bartonella are I quintly a ciated with types fanaem that are n t ob w d in rickett al infections. The evidence favor of the t ausmi s on of both Bartonella and Rick its a by 4 thropoda On the other hand it is generally agreed that n ne of their ekettsine which are rega d das pathogenic h ve yet been cultivated outside of the body except n t saue culture while the extra cellul r cultivation of some of the apecies of Bartonella has all eady been accomplished The efore n the last respect the Bat II may be said to approach ne rer bacteria than R ketts: Howeve it should be emphasized that the Bartonella can ordinarily o ly he first solated cultivated in special med a as N gu h s lept sp al med um

The me B I mid was fi st g y n m n a ticle published in the Jl 4 M 4 n 913 The gene c name was changed th t same y to B # Il (Ha vev lectures 19 3-14)

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The Harvard Commission of 1937 were also able to confirm the cultivation of Bostianella by illyforms on Neguchs a medium from cases both in the febrile Oroya feet stage and in the cuptive vertices stage and to produce verting lessons as monkeys by the innoculators of such cultures. All attempts to produce fatal Oroya fever in healthy monkeys by the intravenous supection of infected blood failed and in only one members that died with tuberculous infection was a mild Bartonella infection of the blood noted at necropsy

In 1911-1924 Mayer observed similar tructures in the red blood corpuscles of mic.

Inch had been treated with Rage or any for typenosome indirection. To these he gas

the name of Barissells myris. Latter it was shown that the same organism appeared in

an anaemic condition following splementumy in rate. It is a thought that they

are also had stimulated a latent infection. Other poces of Bestonich have been described

in dogs monkeys and guicase paig (Neuman 1908) and records on the collivation of it

number of these organisms have also been made

Morphology ~In stained and fixed preparation of blood containing Barbondills bestilliforms both and shaped and rounded forms or earn the red Cells. The rold shaped forms measure approximately from a to again length and from o 1 to a gain a thinking they are frequently slightly curved and occur samply or end to end in parts or in thems of 3 4 and 5. When namerous they often he parabled to one another. V forms probably representing dividing organisms are frequence. I forms are also not undersomma. The ends of the rods in stained preparations are often more intensely colored. Single drops of the short a deep red or purphis grande: Inch may be of the nature of although the short a deep red or purphis grande in the may be of the nature of although and the short and the short of t

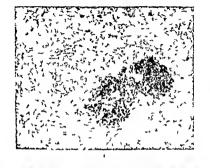
The rounded forms measure roughly from a 3 to 14 in diameter. Shile many of these are rounded others are slightly avail or suggest pear shapes. They occut singly up pairs or in groups which suggest previous drive ion.

The red cells may contain a variable number of parasites. In severe infections from 10 a not unusual. Nucleated red cells at various stages of development are of frequent occurrence and are noneumes infected with the parasites. Barbly Bostonida may invade the leucocytes of the blood as was noted especially by Weimans of air Peru (1937). From the anamena which o curs in this disease and the number of red cells infected with parasites it seems evident that the red cells containing the parasites are ultimately deservoyed.

Bartoneia da illiformia also occurs otten in closely packed masses in the swolenendothelia celle especially of the 1 hyphatis glands system here and kidneys. In cases which die in the Oray feir er stage the endothelia cells liquing the blood and lymbochancels of many organs may be distincted with clusters of Bartoneila. In the endothelial cells of the cutaneous verniga modules. Bartoneila was also encountered some times in very large numbers but of stembon of the cells is much less common than in seen in the cells of organs of the Orays (ever cases. Bartonei-la is also encountered in similar lessons produced in mouleys.)

Recent Methods of Cullisation and Study — Tunkerton (eggs) has cultivated Barboritle in tissue cultivates and has found that in early cultivare annil spheroad closters 1 to 104 in diameter of sharply stained diplobacilary roda appear in the cells. Later usually be the suith day many cells are packed with closters of less sharester organisms often occord granular or smorphous accurately reproducing the juxture seen in human typoph node endoit thum from fatal classes of Down Serve. He found this characteristic pattern in issue cultures made from the blood from the severe anaemic cases of Oroya fever as well as from cases with extraoress very composition of the contraction of the contraction

Wearman and Pinkerton (1938) have recommended for cultivation of Barboulla the agar lant modification of the Nigg Landsterrer Matland method recently deused by Zinssey, Hez and Fitzpatrick for the cultivation of inchestisase. Persh blood serum





Pic 224-1 O systev r ste Arafner s the decofm ly chiann dule X 135 a O ya feve ly shwing a a r e o s ent typ X 100 (H d South Amer an E ped ton R p rt)

In some respects they resemble Bacterium talaceuse another minute organism, which is cultivated more easily than the Bactonello but which also requires special cultiur media for its satisfactory cultivation notal by cystum egar or an eigendoum made entirely of the solk. B talaceuse like the Bactonella shows a tendency to multiply intracello larly and to form large masses of glob or mutorogranisms within the endotheliad cells larly and to form large masses of glob or mutorogranisms within the endotheliad cells.

EPIDEMIOLOGY

Geographical Distribution —Verruga peruana has been regarded as a discase peculiar to Feru in that it had not yet been found to originate in man to any extent in any other country of the world However, recently cases have been discovered in Colombia by Fatino Camargo (1939) and in Ecuador by Montalyan & Moral (1930) **

Rebagliati (1040) gives the limits of the geographical distribution in South America as that region of the Andes between 2 north and 13° south Even within these latitudes the infection is endemic only in the deeply cleft narrow valleys called quebradas formed by elevations of the chains of mountains and the infection is only endemic at altitudes between 800 and 3000 meters above the sea level The climate in these valleys is rela tively hot in the day time but cool or cold at night. They are watered by mountain streams and by rainfall. The vegetation is peculiar and scanty consisting especially of verophytic or euphorbiaceous types except where there is direct irrigation from numerous aqueducts led from the river which flows through the valley here fruit trees are cultured Insects are prevalent especially Phlebotomus verrucarum and P noeuch and Anopheles pseudopunctipennis and A arguithesis and species of Culer The permanent inhabitants are few and most of those who reside in the endemic regions are infected with the disease. In such regions Rebagliati points out children are infected in very early years and those who visit the region for the first time usually become fatally infected if they do not take prophylactic measures. He outlines the geographical distribution in Peru as prevailing in two regions (1) the Pacific water shed which includes 21 zones which correspond with equal numbers of hydrographic formations that spring from the western slopes of the Andes and run to the Pacific and (2) the Maranon watershed which is the region surrounding the 18 rivers tributaries of the Amazon

In Colombia the disease has been reported by Patino Camargo (1940) from a jungle region the Department of Namon near the Ecuadorian barder and in Ecuador in the Trownee of Logia by Montalvia and by Moral (1940) next the northern Peruvan border of the disease. In Namo the disease occurred in severe epidemic form in 1935, 39 with a high morathly and under similar ecological conditions to those present in the endemic regions in Peru. It was identified by I almo Camargo as baricocilous. This fact has been thoroughly confirmed by Conto (1941) and his associate who also found that the serum of the cases showed no agglutuation to any of the Profess organisms or of to typhoid or prastal phond battle or Br. ello

Asymptomatic cases of the disease residing in the Verruga zone have been discovered in Peru Mackeheme has reported the presence of Bartonella in the blood

Hertig (1940) has stolated B basilisforms; from the blood of a suspected case of the disease in Ecuado: The organism was inoculated into a South American monkey probably a species of Cebus in the left eyebrow and left side of the abdomen and verruga persuan nodules developed.

PATHOLOGY

In cases which bave died in the Oroya fever stage at autopsy the skin often shows the pale vellowish wars hue of permicious anaemia lymphatic glands are usually somewhat enlarged and may be oedematous The heart muscle may be flabby and ecchymoses may be present in the pencardium The spleen is enlarged It may show numerous infarctions and contain large amounts of pigment in the form of yellowish masses or granules deposited between the splenic cells and in the endothelial leuco cytes This pigment is like melanin in not giving the iron reaction liver likewise is enlarged infarctions may be present and areas of toxic degeneration may occur and contain moderate amounts of pigment femoral marrow is soft and dark red. Microscopically, the endothelial cells of the lymphatics distended with the causative organisms were par ticularly noted by the Harvard Commission of 1013 Bartonella bacilli forms is found in the red cells and in addition particularly in the cells of the reticular endothelial system The vascular endothelial cells especially of the lymph glands spleen liver and sometimes of the kidneys are often invaded with clusters of organisms

Microscopical examination of the cutaneous lesions present in the verruga stage show that the lymphatic channels are often obstructed by a cellular exudate and around such lymphatics plasma cells and fibro blasts are encountered. There is marked dilitation of the capillary blood vessels The structure of the nodules is granulomatous and very vascular in places almost cavernous hence the tendency to haemorrhage. The early lesions consist of newly formed blood vessels lying in an ocdematous connective tissue The endothelial cells lining them may be proliferated and in more than one layer Around these blood vessels there are aggre gations of angioblasts which show frequent mitotic figures. The lesions in the early stages are particularly haemangiomatous in character Later they may show a resemblance to fibrosarcoma. Especially in tissues prepared by Regaud's fixation followed by staining with Giemsa Barton ella are often demonstrable in the endothelial cells of the verrugas though these cells in the verrugas are not distended with the microorganisms as commonly as they are in the endothelial cells of fatal cases of Oroya fever

SYMPTOMATOLOGY

Verruga peruana or Enfermedad de Carrion may include two very different chincal syndromes (r) a severe often fatal febrile anaemia (Oroya fever) and (e) a cufaneous verrucous eruption of haemangioma like nodules (vertuga peruana)

OROVA FEVER STAGE

The incubation period is usually given as about 3 weeks (16-22 days Escomel 1938) and the onset of the disease is marked by malaise and apath) to be followed by a rapidly developing anaemia of the permicious

of persons not presenting any symptoms and positive cultures of Bartonella have been obtained in such cases by Battistini Weinman and others Weinman secured positive blood cultures from 5 persons in none of whom could Bartonellas be found in blood Three of the cases had no past history of Bastonella infection The other two gave a history of cutaneous verruga 6 months previously It is suggested that such cases may constitute an important reservoir of the virus. It seems possible that certain vertebrate animals may play a similar role but this has not been successfully demonstrated

Wess and Pons (1018) have shown the infection of dogs with Bartonella canit in Peru sometimes producing a fatal infection with anaemia. The organism honever apparently is different from the human one. No cutaneous verrugas were observed Samper and Montoya (10,10) report that in Colombia the common dog was found to be quite susceptible to experimental infection in almost all cases. Many developed verrugae and some died of the discase

Verruga peruana prevails particularly from January to April towards the close of the warm rainy season when the streams are in flood and the temperature is high and moist and when insect hie is abundant and malaria also prevails. Entencievers and e pecially paratyphoid and malaris are very common in the localities where Oroya fever is endemic

Transmission - Townsend in 1914 conjectured that the insect vector was a sandly Further evidence incremins time P. Noguckes and P. serrucarum was obtained by Nogu chi Shannon Tilden and Tyler in 1929 And Battistini (1931) reported that the bite of Philebotomus can produce infections in the monley Two mankers inoculated with crushed thes developed lesions and he reported cultures of Barionella from Phiebolomus Hertig (1937) also demonstrated that in sections of Phlobotomus verricarum and Phirbo fomus noguch; fed on Oraya fever cases the Bartonella like organisms may be present in the lumen and on the surface of the midintestine without honever any invasion of the enthelial cells. No definite transmitting experiments to man with the living insect have so far been accomplished. Honever in his transmission experiments with wild sandflies Hertig succeeded in infecting 5 of 8 monkeys. He also observed an organism resembling B bacelliformes in the proboscis of certain sandlies. Hertig (1942) in further investigations has found massive infections of the tip of the probostis of Palebo formus with a minute radlike or coccoid organism. They have been found in both males and females of three species of the flies from the Peruvian Versuga zone Over 300 such infections have been observed. The proportion of sand thes infected was frequently as high as ag or so or The character of the proboscismfection as to microscopic appear ance intensity and distribution on the mouth parts was remarkably constant and annarently bore no relation to species sex age or the presence or absence of a blood meal

The source of proboscis infections he states is unknown Its occurrence in male flies which do not suck blood and in females which have never had a blood meal toda cates that the infection is probably acquired when sand flies seek other sources of liquids Out of about 300 uncontaminated cultures of the proboscis B bacilliformis has been recovered trace and an un named micro organism of similar morphology about to times. There was some difficulty in the primary culture of the proboscis organisms since about half of the uncontaminated cultures yielded no growth whatso He concludes that the data thus far are manificient to make clear the extent to which Bartonella enters into these infections and whether or not they represent the mechanism of transmission of Carcion's Discuse. Hertig has been carrying on these studies since 1937 and his most important work should be read by all interested in the subject Brumpt spent to days in Namino in 1939 Among Phiebotomus he collected and took back to I are for classification were specimens of a different species two of hich had not been de cribed Brumpt reported no attempts at experimental infection and it is not knot a whether these species bite man. He says none of the species which had been found in Peru were encountered in Colombia

Considerable other evidence has been obtained of the transmission of other species of Bartonella by Arthropoda Transmission of Bartonella canis is known to occur through the dog fles (Cienocephalus) (Kikuth) and Barlondia murss by the rat louse (Rasmatobinus) (Mayer) and sat flea (Venopopla cheofus) The transmission by the Lat louse (Polyplax serrala) was first shown in the United States by Cannon and McClel

land (1935)

with a more or less general eruption of verruga—and acute cases in which there dominates an intense amemia with poorly defined febrile reaction usually ending with the death of the patient (syndrome of Carrion or Oroya fever) those sho escape death present also verruga eruptions Between these two chimcal extremes

there are a series of intermediate cases varying in quantity quality and duration of the symptoms which gives to every patient an individual chineal aspect all types of cases are met with from the simple afebric case of verruga with cutaneous lesions to the fulumiting permicious anaema type. In less marked cases of Oroya fever we have the onset of verruga lesions during convalescence. Persons who have had either Oroya fever or verruga are said to remain immune to both.

Verruga Peruana Stage

Vertuga peruana is an infectious cruptive disease lasting 2 or 3 months and characterized by successive eruptions exhibiting 2 types of lesson—the miliary and the nodular—both of which show a pronounced tendency to haemor thage and sometimes to ulceration

The period of incubation is often indefinite and has been said to vary between 30 and 60 days kuczynski (1938) who inoculated himself on the arm with several cultures of Bartondla experienced symptoms of marked asthenia atticular pains and a fever which reached 40 C such symptoms beginning 17 days after the inocula

reached 40 C such symptoms d tibut on of redulat on (Hrvd beginning 17 days after the inoculation and followed shortly afterwards by the development of 2 large

verrugas on the forearm and a senes of small ones of the military type upon the forehead eyelids and legs. The onset of this stage of the disease may be characterized by rather

severe pains of the joints especially the knees ankles and wrists together with a fever sometimes reaching ro4 F but usually not above 100 F or

anaema type, with an irregular fever of a remittent character fluctuating between roe" and roe" F and only exceptionally going up to ro4 F. Pains in the head joints and bones are common. The tenderness over the bones is apparently associated with the marked changes in the bone marrow and may be particularly marked over the sternum.

The patient rapidly develops a very severe anaemia and death results in 20 to 40 per cent of cases in 20 rg weeks. Delinium is often noted. The splient and the jumphatic glands are somewhat enlarged. A sociated with the protound anaemia there may be oedema of the legs and about the innits and functional cardiac murmurs. The kidneys are not generally seriously affected although albuman is apt to be found in the urine. There may be a diarrhoea in the later stages of the disease. There is no eruption in the severe febrile stage. In severe cases, various manifestations of haemorrhagic character, as petechial spots and hleeding from the gums have been recorded.

The most important findings in the disease are those in connection with the blood examination. The rod shaped organisms, which are helieved to be the cause of the disease are difficult to observe in fresh blood preparations. They may show definite motility within the red cells particularly after warming the blood side. In Romanowsky stained preparations the 1 to 2 micron long rods within the red cells may occur singly or in numbers of 4 or 5 V shapes are frequently seen. The rods show a bluish ataming with a deep purplish red chromatin stained granule at one extremity. Rounded oval, or pear shaped forms may at 0 be een While the parassites are present in great numbers in severe cases they may be very scarce in mild forms of the disease. Noguch considered the making of cultures superior in diagnosis to the examination of stained sincers.

Blood—Bartonella baciliforms may produce in man an ansemia of the greatest intensity and rapidity. The hermoglohin may he reduced within a weeks to 0-30 per cent and the red cells number 1,000 000 to 2 000 000 sometimes less than 1 000 000 with the color index usually greater than 1. The anaemia is usually macrocytic in type, while ansocytosis and positio cytosis are marked features. Reticulocytes, normoblasts erythroblasts and megaloblasts may be numerous in the peripheral blood. The bone marrow is hyperplastic the reaction being of megaloblastic type. In severe infections over go per cent of the red blood corpuscles may be pressitled. The leucocytes are usually increased and may number about 0 000 of which 60 to 70 per cent are neutrophiles. Immature neutrophiles as the metamydocyte are very common

If the individual does not die in the anaemic stage within a few weeks a gradual improvement in the constitutional symptoms takes place and then frequently an eruptive or vertucous stage follows which is character ized by the appearance of papules or subcutaneous granulomatous nodules

Ribeyro states that in the clinical evolution of the disease there are beingn cases—irregular febrile periods accompanied by variable phe nomena generally painful and a certain degree of anaemia which ends genera represented and that one or more strains of each genus might be present

An exception to the traditional vew has been found in a recent article by the Peruvan physician E Escomel (1938) who under the heading Battonellose fruite relates a case with low grade anaemia and lever with Battonellos in the blood in which after treatment the fever and Battonella as the blood in which after treatment the fever and Battonella assonabment Escomelabo in a discussion of Battonella battliforms: the agent causal refers to the fact that the histoid or eruptive stage may be macroscopic or microscopic but be does not say whether the micro scopic cruptive lessons were detected during life nor does he describe them in such connection.

Mackehenie has reported the presence of Bartonella in the blood of persons not presenting any symptoms of the malady and Battistini Weinman and Hurtado (1938) have secured cultures of Bartonella from the blood of apparently healthy individuals living in the vertuga zones

Pittaluga (1935) who has studied flattonella; fections in ratis and in dogs points out that human Bartonella infection is not comparable in its evolution with the infection of animals caused by B murss and B causes for the desage in monkeys caused by the unjection by B baccall forms; and that the last organ sm should be sepa ated from other members of the group.

We set of Jame (1027-018) or an important and interest; a ritide suggested that is the termination of tha Orea, he is or to beausite phase the v rus becomes interf in the tause and the b stool reticulo-endothel. I reaction so produced leads after a varying interval to the production of the verries modules by the production of the verries modules by the productant retirement of the terries modules by the productant retirement of the terries modules by the productant retirement of the terries of the strong history and the strong history phase there particles of the character of an afterpre reaction. In the second history dpase there

may be a reaction either with or with at eruption Howe (943) has c rned out extensi e m n l gic stude in e ard to the d s a e with special elerence to the gglutination tests. He reports that a measurable titer f agglut nine t p obably of p oduced in all pe ns with Carr on a d sease. On the oth ha d it appea s that agglutin a when they do occur ar detectable m st ften durin the early acut naemic stage (clinical or subclinical Oroya fe e) hen blood cultures a e regularly p t e for B bac Ilf rmis and the pa asite is oft a detectable n th blood smear. Fr m ob e vations made on several pat its at diffe t stages of th de ascit emed p hable that the titer of g lutining rises and m at often peak just p ; r t the app a ance of the erupts n In the ma; rate of ca es m h ch erupt ns occu red the wa apparently a decline in tite as the erupt oup re se and finally suited a In the may twafter all e dince fe upts a had ub did a glutin as ve found in the serum. In many a tances blo de litures pis tief I bacill form: I risted longe than a p sitive as lut n i on to t. H. thou ht it lut splayany may part in thalmost une lacqui Immun ty which he thought fill ed the typical el cal disea o in the app t nmunity which might b prese tim long term ident f demic center h deny a thit > of the nfection. Non minume p sons whe had rec. df> maldehyd i ated vaccine de el ped agglut nins but appa ently these arelut in did not pre ent in asympt in 1 c from occu ing when u h person e c exp d 1 th disease in n e demic eg n as cultures mad from their bl od excaled th pee cool b b llfrn

All o h reports the select that adm. fath n of p efe h) morne erabbit many high again un titred each ont thus the bid of a morney high case feve O on fe The against at on test did et seem to be figreat use their in det min g pit afterion or i estimate gith degree of monorally a person a bound of the major ly fiftee cases did not ocur in distinct beyond the major by fiftee cases did not ocur in distinct beyond the major has been did not occur in the case that did not seemen that the gith did not seemen that the self-upon time the self-upon that the of dispositions segment as

the fever may not be noticed
Following the eruption the temperature usually subsides to normal in a few days
The eruption shows a types the one with numerous, small warf like fections not exceeding the size of a small pea (2 to 5 mm)—the military type and the other, with less numer ous but much larger nodular masses—the nodular type
The latter type is more rarely seen than the former

The Miliary Type —The eruption is most abundant on the face and extensor surfaces of the extremities and less common on the front. In this type a pink macule appears which rapidly takes on a bright red color and becomes nodular. These nodules may be flat or somewhat peduncu lated and bleed easil. At first smooth and shiny, it later on shrivels up without leaving a scar. This form of the eruption may involve the mucous membranes as of conjunctivae nose pharynx etc. In children the diseases is usually of a mild type.

The Nodular Type—The nodular cruption develops slowly and the lesions may become as large as a pigeon's egg. They tend to become strangulated and then show as ulcerating fungating masses which are a source of danger from haemorrhage, (Mulaire lesions). The nodular cruption does not invade mucous membranes and is susually confined to the regions of the joints as flexures of the elbows, knees, etc. The crup unon stend to come out in crops and the durition of the descare extends over sor 3 months. The nodules are formed by the proliferation of the endoubles are called and formblasts.

GENERAL CONSIDERATIONS

In none of the lower animals in which Bartonella infection has been reported has a verrucous stage of the disease been observed and the presence of verruga lesions has never been observed at autopsy in any of these animals. The writer still inclines to the opinion that in man, just as in animals Bartonella infection may sometimes pursue its entire course without the appearance of a verrucous eruption and either terminate in death or recovery That the former is true seems to be generally agreed However apparently the traditional view in Peru until recently was still to the effect that if the patient is to recover the verruga eruption either scants or profuse must occur Tyzzer who has especially studied the organism in the red cells of the field vole in a paper published with Wein man (1010) has proposed that the organism in the mouse described by Mayer (1021) and the one in the vole should both be classified in the genus Harmobartonella indicating that both are found only in red blood cor nuscles and not in other cells as is B bacilliformis This brings up as ain the question of whether one species of Bortonella produce only Oraya fe er and a second one a milder type of infection with a verrucous eruption Namer (1939) points out that if this differentiation applies in the case

of Bartonella infection in man another explanation for the variations in sumptomatology can be given namely that each infection may vary in the

However the general opinion among a number of the most conservative Peruvian physicians today is that the severe infections have not been favorably influenced to any great extent by this drug or any other drug treatment or by transfusion of normal blood Cases which we observed treated with this compound 386B and other antimony compounds were not noticeably favorably affected Such drugs were employed in three of the cases we observed which resulted fatally Ribeyro (1040) at the con clusion of his monograph states there is no specific therapeutic treatment for this disease Treatment should be designed to building and strength ening the resistance of the patient who is suffering with the syndrome of Carrion and an attempt should be made to supply the organic elements that have been destroyed to foster blood regeneration and to excite at the proper moment in the evolution of the disease the defensive functions of the reticulo endothelial system. Hence the successful treatment of severe Bartonella annemia in man would appear to be still an unsolved problem

In the treatment of cutaneous verrugas the ordinary principles of cleanliness apply to the care of the lessons to prevent secondary infections. When the large tumor like masses begin to ulcerate or become gangrenous some advise that they should be excised. It must be remembered that

dangerous bleeding may occur at unexpected times

Howe has prepared an immune serum of high agglutinin titer in rabbits by the intravenous administration of large amounts of B bacilli forms both in the fresh and in the formaldehy de treated state. The titer was usually 1 500 Three cases of severe Oroya fever were treated man of 51 another of 21 and a lad of 15 years The first had 10 cc daily intravenously on the 20th-24th days of the disease having 50 cc in all The man of 2r had on the 21st and 26th days of illness 100 cc and 150 cc transfusions of whole blood (the donors had never had Carrion a disease) and from the 24rd to the 27th days 10 cc doses daily of the immune serum The boy of 15 had a total of 60 cc namely 10 cc on the 8th 10th 12th 13th 14th and 17th days of illness In none of the three was there any very definite change in the chinical picture as a result of the serum therapy However in the boy the typical miliary eruption appeared unusually early on the 14th day of illness Whether there were any indications of serum sickness is not stated. In all three there followed shortly after the injections began an appreciable diminution in the percentage of erythrocytes infected with B bacilliformis as determined by examination of blood films and Howe thought that the reduction appeared to be more gradual in other cases which had not received immune serum. He also noted that in these 3 cases a diminution occurred in the number of colonies of the organisms obtained in cultures taken during the time the treatment The type of colonies obtained in cultures taken before and after administration of serum indicated a change from finely granular and diffuse growth to a coarse and sparsely scattered type of growth changes were retained in transfers from original blood cultures and their significance is not clear It remains to be determined whether the change in the number of infected corpuscles was merely coincidental with or was 1012 TREATMENT

Complications and Prognosis —The disease is frequently complicated with maltria Paratyphoid lever has also been a common complication and Rebeyro believes that when this infliction coerusts the prognosis is rendered much more unfavorable. The very severe febrile anaemic cases usually result fatally Those with vertucous eruptions frequently show few unfavorable symptoms and are very rarely fatal unless complicated by other infections.

In children the disease is often mild Latent forms of infection without apparent symptoms have been shown to exist

Mera (1943) has summarized the present knowledge of the subject and some of the investigations performed recently by Perusian and Colombian physicians

TREATMENT

Treatment which has been found successful for other macrostic anaemias as pernicious anaemia tropical nutritional anaemia and sprue is not effective in Bartonella infection in man as might be expected since the former are deficiency diseases and the latter an infectious one Kuezyn ki (1937) believed that vitamins, and especially vitamin Bi produced a favorable effect on the infection. There have been a number of reports of the efficacy of the administration of iron and copper in the infectious anaemia of rats which develops after splenectomy Perla and Gottesman have reported that when the animals are fed iron and copper before the removal of the spleen Burt rel's infection does not develop Perla believes splenectomy causes increased elimination of copper and states that animals on a normal diet do not receive enough copper to prevent the development of the infection after the spleen is removed. It is also stated that neosalvarsan administered before splenectomy presents the development of the anaemia in rats and if administered after the devel opment it has a marked effect. In the treatment of infectious anaemia of dogs, which anaemia however is seldom severe (in at least some localities) and death is infrequent peosalvarsan is said by Kikuth to exercise a specific effect. However this is not the case in human Barlonella infec tions It has been conclusively shown by a number of Peruvian physicians that the most severe anaemic cases usually result fatally in spite of such treatment Kikuth has recently (1937 and 1938) written of the value of an arsenic antimony compound designated as SDT 386B, which con tains 18 per cent of arsenic and 20 per cent of antimony, a brown powder, readily soluble in water It is stated that the lethal dose for rats is 750 mgm per kilogram and the well tolerated dose 500 mgm per kilogram In heavy Bartonella infections in rats o 2 mgm fer kilogram is said to be effective and to have a specific action. Likuth further states that Manrique has obtained noteworthy results in the treatment of 14 cases of Oroya fever in Peru for which he admits hitherto there has been no treatment other than symptomatic Dose of or to o 3 grams repeated two or three times brought about disappearance of Bartonel'a from the circulating blood and initiated an increase in the erythrocyte count and a rapid improvement in the general conditions

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directly consequent on the injections though this suggested that the serum had some effect in clearing the organisms from the blood stream

PROPHYLAXIS

Prophylaus consuts of a working the endemic districts after nightfall if one is compelled to remain in them he should protect himself after sundown beneath a mosquito net with a fine mesh, or be in a screen proof room. It may be recalled that Shannor while studying the epidemic oligical conditions and the question of transmission and while collecting usects lived for over 4 months in the endemic lones. Nevertheless be exercil in such precautions he protected himself from infection.

It is difficult to find or to eradicate the breeding places of Phleb ' m is

in the endemic zones

Human cases of the disease, either active or as latent infections constitute reservoirs of infection in such regions

PROPHYLACTIC IMMUNIZATION

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SECTION IV

NUTRICIONAL DISORDERS

The study of the deficiency diseases since the last edition of this book has become a specialty. Also the literature upon the subject is now so sast that recently several special text books relating to the vitamins have been published.

Dr George C Shattuck for a number of years has been devoting special tudy to the deficiency diseases and he has kindly agreed to summarize our modern ideas on the subjects discussed in this section

Chapter XXX

MALNUTRITION, NUTRITIONAL OEDEMA, EPIDEMIC DROPSY

Introduction—The distribution of most of the nutritional disorders is world wide Only the e which are particularly common in the Tropics or sub Tropics will be described in this Section

With regard to the vitamin deficiencies Mackle (19,10) has emphasized important concepts based upon the newer knowledge of this subject. He said. Various of the vitamins have been shown to be the active or prosthetic fractions of enzymes which are essential for the breakdown of foodstiff in intracellular metabolism. In the earlier stages there is disturbance of function only. If the process advances far enough demon strable anatomical lesions appear. Thus the estimated incidence of nutritional deficiencies will depend upon whether or not early signs of deficiency, have been accepted as criteria for diagnosis.

Several observers have pointed out that vatamin deficiency may be associated with dysfunction of the digestive glands or with disorders of some of the glands of internal secretion

There are grounds for believing that deficiency of certain vitamins may lower the threshold of resistance to bacterial infection and perhaps also to virus infections and metallic possons which attack the nervous

A key to the recent literature on the vitamins can he found in the series of authoritative articles first published in the Journal of the American Medical Association under the auspices of the Council on Pharmacy and Chemistry and the Council on Poods of the American Medical Asso

ciation and subsequently brought together in book form as The Vita mins 1939 Each of these articles includes a comprehensive reference list New and Nonofficial Remedies, published yearly by the American Medical Association provides pharmaceutic information and defines 'allowable claims for vitamin preparations The "Tropical Diseases Bulletin reviews periodically most of the important literature bearing on nutritional diseases of the Propics In The Avitaminoses' by Eddy and Dalldorf (1938), the more important original courses are listed at the end of each chapter

In their book entitled "Vitamin B r (Thiamin) and Its Use in Medi cine R R Williams and T D Spies have evaluated current knowledge of beriber, and allied nutritional disorders up to 1038

In a monograph published by Dr I con De Soldati Buenos Aires Argentina 1940, entitled Los Trastornos Circulatorios de la Avitaminosis Br he has discussed in detail the circulatory disorders resulting from deficiency of Vitamin B 1 in man and in animals

Deficiency of Vitamin D which manifests itself in children as rickets and in adults as osteomalacia, has seldom been observed in the Tropics There have been a few cases of 'rickets' reported from Puerto Rico but there is reason to believe that most of these diagnoses were erroneous

Anaemia, mild or severe, is widespread in the Tropics Malana ancylostomiasis sprue and scurvy account for a large proportion of the anaemias. Most of them are hypochromic or microcytic in character and they usually respond well to iron The anaemia of malana is attrib-uted chiefly to blood destruction and that of ancylostomiasis to chronic blood loss In either case there is a deficiency of iron. The anaemia in sprue and alited deficiency syndromes results from deficiency or absence of the extrinsic or of the intrinsic factor of Castle or from a deficiency of both factors. These anaemias require liver extract for their cure. In scurvy, the anaemia has been traced to deficient production of crythrocytes by the bone marrow The response to administration of vitamin C is dramatic

Pathological Physiology and Clinical Description of the Anaemias by W B Castle and G R Minot (1936) contains much information relat ing to the nutritional anaemias of the Tropics The milder grades of anaemia are often associated with malnutration or attributable to one or more of a great variety of disorders

MALNUTRITION

Definition -By the term 'malnutrition" is meant a condition of sub-optimal nutrition which may or may not be associated with recognizable signs of any well defined deficiency syndrome. The weight to-height ratio or some other index of the level of nutrition may be useful for the recognition of mainutrition in a borderline case. Such indices are of limited value however because they vary considerably within normal limits, because water retention may occur with or without oedema and hecause certain deheiency syndromes are not necessarily associated

with los of weight Bigwood* (1939) has described and discussed the methods of making nutritional surveys and of recognizing malnutrition in individuals

Incidence — Mainutrition is very common in many of the indigenous race of the Tropics. Among the common causes of mainutrition in these groups are periodic or permanent scarcity of food chronic or recurring diseases loss of teeth and dislocation of habitual modes of life incidental to modern progress. The nutrition of individuals of the white race residing temporarily in the Tropics suffers in many instances from failure to eat the fresh fruits and vegetables which are obtainable locally from other unhyequence habits or from disease.

ETIOLOGY

Food which has been ingested remains physiologically outside the body until it has been absorbed. Probably some of the disorders of metabolism which are not dependent primarily on misinturtion may interfiere with the utilization of essential food factors even after absorption from the intestines has taken place. Thus nutrition depends first on ingestion of adequate amounts of all essential food factors second on their absorption in sufficient amounts and third on their efficient utilization by the tissue cells of the body.

Some of the recognized loak of specific substances and the known vitamins of the symptoms are curable by means of unknown substances contained in liver Frequently in individual cases two or several essential food factors may be insufficiently available. The patient may then exhibit a combination of symptoms which does not fit into any of the well known deficiency syndromes.

TREATMENT

Treatment of malnutrition requires recognition and removal when possible of the underlying cause. This may involve improvement in diet or in living conditions adequate rest and perhaps specific medication for anaema or for vitamin deficiency or treatment of some concomitant disease.

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NUTPITIONAL OEDEMA APD EPIDEMIC DROPSY

Synonyms -- Acute Anaemic Dropsy War Oedema Famine Oedema, Prison Oedema, (?) Epidemic Dropsy *

Definition—"ultritional codema is generally attributed to deficiency of protein in the diet. Recently published textbooks have throna together nutritional codema and epidemic dropsy. The descriptions of many cases of epidemic dropsy seen in India indicate that this disease is often associated with skin lessons which are not seen in ordinary cases of nutritional codema. Therefore one may doubt the identity of the Indian form of epidemic dropsy and nutritional codema.

Incidence —Local outbreaks of nutritional oedema or of epidemic drops have been reported from India Mauritus and Fiji from Tennes ee (Youmans 1934), and from Spain during the recent civil var (Jour Amer Med Assoc 1939) Nutritional oedemi has been prevalent at times in Java and among prisoners in Haiti. It was common in Central Europe as a result of semi starvation during the World War. In India epidemic dropsy is seen especially during the rainy sea on or subsequently when the weather is cold. Outbreaks do not occur every year. Probably sporadic cases of nutritional oedema may be found almost anywhere. Doubliess there are cases in which oedema of nutritional origin is associated with dehenency of various other food factors.

ETIOTOCY

Youmans et al (1032) studied 12 cases of mild nutritional oedema They stated that in all but one of their cases the total calone value of the food ingested was below basal requirements, that the average protein intake ranged from o to 52 Gm daily. In 8 of their cases, it was below the usual minimum of o r to o " Gm per kilogram of body weight subsequent report (1933) on 3x patients they found that the total proteins were usually normal the serum albumin slightly or moderately reduced and the globulin normal or increased Calculated colloid osmotic pres sures (using Govaert's factors) were slightly or moderately below normal in the majority of patients with oedema. When the protein in the diet was increased the albumin tended to rise gradually and the oedema to disappear. It was believed that reduction in the serum albumin was especially against but that other factors such as intake of water and salt and perhaps a nutritional injury to the endothelium of the capil larges, might be factors of secondary importance. The normal range of serum proteins was considered to be as follows total protein 6 5 to 8 5 per cent, albumin 4 2 to 5 7 per cent and globulin 1 3 to 3 0 per cent

Reduced specific gravity of blood serum has been reported (Pasticha La) and Malik 1938)

* One form of epidemic dropsy is now attributed to pol oning by an adulterant of mustard of See page 1210)

The main factors which can enter into the production of oedema have been discussed in detail by Peters (1935) and presented briefly by Landis (1935) Experiments by Lepore (1932) on dogs show that increased intake of fluid and of sodium chloride hasten the development of oedema With regard to his work on tocema in pregnancy Strauss (1937) said

The evidence presented suggests that the manifestations of 'to'cemia of pregnancy in the patients studied resulted from water retention conditional upon hypoproteinemia and that The administration of sodium is dangerous in pregnant women with hypoproteinemia. He said that sodium bearbonate and sodium chloride are equally detrimental Subsequently Strauss and Fox (1940) reported that anaemia per se appears to be a cause of water retention and that the retention after administration of sodium chloride is inversely proportional to the haemo globin level Weiss and Wilkins (1936) after studying cardiovascular disturbances in vitamin B i deficiency stated that the ordema observed in their cases could not always be explained either by the degree of circu latory failure or by lowered somotic pressure of the blood plasma. This observation is difficult to interpret Vedder (1940) has attributed the ordema of wet berbers to embarrassment of the right venturied alone

Elliott (1933) said that Depletion of serum protein occurs clinically as a result of protein restriction in diet protein waste as in albuminuria or as a result of disturbed metabolic processes and that when serum proteins are depleted below a level of 3 or 4 Grams per cent oedema may appear. He believed that Disturbances of the acid base equilibrium of the serum are probably of serood importance in determining the state.

of hydration of the body

According to Mecray et al (1937) patients who have peptic ulcer or gastine malignancy often suffer from nutritional defects and when the dehydration which they so frequently exhibit has been overcome they may have hypoprotenemia with or without oedema

Sharp (1935) Carman (1935) and previous observers have described a mysposedly nutritional disease associated with so defems which occurred an Kenja and the Gold Coast Most but not all of the cases were in infants. The symptomatology suggests the coexistence of multiple dictary deficiencies

When war oedema appeared in Central Europe there had been a prolonged detary shortage of fats but there may also have been a deficiency of protein in the diet. Mann is (1938) observations on prisoners in Hatil led him to believe that deprivation of direct exposure to sunlight was an important causature factor in his cases of oedema.

Many cases of epidemic dropsy reported from India have exhibited neurologic symptoms suggesting beriberi. This fact seems to show that features of epidemic dropsy and of benbern may occur together. Out breaks of dropsy are particularly common among people whose staple diets is builded ince.

The cause of epidemic dropsy in India has been the subject of much study. The infectious theory is losing ground. The view that the disease

is caused by a toxin which has been found in damaged rice has inadequate support. Pure mustard oil is free from any tonic principle but an adulter ant of mustard oil (argamene) appears to have toxic effects. Some outbreaks of epidemic dropsy have heen attributed to this substance. On the other hand, it seems highly probabile that many cases of epidemic dropsy are due essentially to du orders of nutrition.

PATRIOLOGY

No characteristic lesions of the internal organs have been described De and Chatterjee (1935) have studied the pathology of epidemic dropsy in India with special reference to the skin. They attributed the erythema to vascular dilatation and the 'ccchymotic patches to relangicetass. The nodules which were found on the mucosa of the mouth, tongue and nose as well as on the skin contained dilated vascular spaces.

Dilatation, especially of the right side of the heart with thinning of the wall and separation of the muscle fibers by dilated capillaries, some what similar changes in the chiary body of the eye and evidences of glaucoma were observed in some of the cases. The membranes of the spinal cord and of the peripheral nerves showed marked 'vasculariy' but there was no degeneration of nerve fibers.

SYMPTOMATOLOGY

The oedema may be slight or pronounced Generally, it begins in dependent parts. Oedema of the face and anasarca may develop Associated signs and symptoms are enternelly variable They proclude increasing emaciation, muscular weakness irregular fever or subnormal temperature distributes and vomiting pleural and pencardial effusions hrad/cardia or tachvoardia and dyspinoca on exertion loss of knee perka and sensitiveness of the calf muscles to pressure and various ocular lexions. Pregnant women frequently abort

An intimate relationship between non inflammatory glaucoma and

nutritional oedema has been pointed out repeatedly

Skin —In epidemic dropsy vanous types of skin lessons have been observed historin purplish red erythema which produces pigmentation vascular nodules or startods, large or small which sometimes are pedimentated rash on the legs, pigmentation of the fave and of other exposed parts. The crythema is due to telanguettasis and the vascular nodules are hemangioma. They bleed readily and profusely when damaged (Chopra et al. 1035 and De and Chatterjee 1935 Ghosh 1941). The critical field is skin lessons bears no relation to the severity of the illiness. The form of epidemic dropsy resulting from the ingestion of argemone oil is discussed on page 1210.

Blood—The haematologic changes were studied by Chatterjee and Halder (1935) They found little reduction in the crythree; te count but sometimes the haemoglobin was markedly reduced. The leucocyte count was apt to he reduced in the early stages but not subsequently The jymphocytes and the cosmophales were relatively increased. To surcells were described. They were leur ocytes of a peculiar type exhibiting

vacuolization and hasophilic granules

It seems highly probable that the clinical picture in many cases of mutitional ocdema depends upon the evistooce of multiple deficiencies. The cardiac symptoms and the sensitiveness of the call is and the loss of knee jerks are highly suggestive of deficiency of vitamin B 1 and some at least of the ocular lesions might be caused by deficiency of vitamin A The cause of the skin lesions is by no means clear. The anaemia might be caused for mon deficiency.

DIAGNOSIS

Oedema associated with evidence of malnutration suggests the diagnosis of nutritional oedema. An epidemic without neurologic symptoms which occurs in a labor gang, in a prison or in a population group is likely to be caused by a deficiency of protein in the diet. When some of the cases show signs of benjeer or of some other well known food deficiency, there is a bigh degree of probability that protein deficiency may be a factor in these cases as well as in those showing oedema only. Probably oedema which may be of nutritional origin occurs in connection with a great variety of diseases in which nutrition is disturbed through inadequacy of the diet defective utilization of food or pronounced loss of protein as in chromic nephritis. Decrease of serum albumen alteration of the albuming globulin ratio lowered osmotic pressure or decreased specific gravity of blood serum favors a diagnosis of nutritional oedema. The skin lesions when present may be of various types.

Prognosis - Mortality is low as a rule Deaths are usually attributed to cardiac decompensation. It seems possible that Br deficiency

may be the true cause of such deaths

TREATMENT

The first requirement is a diet neh in protein and vitamins and of high calone value. When oedema is pronounced the intake of fluid and of sodium whether as sodium chloride or sodium bicarhonate should he restricted. Cardiac symptoms when they occur suggest that vitamin B: should be administered in adequate dosain.

The skin eruptions of epidemic dropsy are said to respond to a high protein dietary and good results in glaucoma have been attributed to

similar methods of treatment

Haemorthages from injured nodules may be prolonged and severe Bleeding must therefore be watched for and controlled Anaema when marked may require treatment with iron or with liverextract. After massive hiemorthage blood transfusions are indicated. They not only help to restore the cellular elements of the blood and the haemoglobin but they combat the depletion of serum protein.

Parenteral injections of various proteins have been recommended

recently Their use is still in the experimental stage

Methods of dealing with hypoproteinemia in postoperative surgical cases have been discussed by Raydin et al 1040

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Chapter XXXI

SPRUE

Synonyms—Pailosis Ceylon Sore Mouth Cochin China Diarrheca Definition—Sprue is an affeirle chronic or relaying disease character uzed by the passage of stools which are voluminous mush; the color of putty and sometimes frothy The classical associated symptoms are weakness emiciation gastro intestinal discomfort changes in the tongue and anarmis.

Geographical Distribution —Sprice is common in Whites of European origin who are living or who have lived in southeastern Asia the East Indies India Ceylon Puerto Rico or the West Indies Sprice has been reported less often from other tropical or subtropical countries. Strange to say sprice seems to be rare in Africa. Sporadic indigenous cases of non-tropical Sprice have been reported from many parts of the temperate some including the United States of America and many of the countries of Eurons.

Incidence -Sprue usually develops in the middle period of life and

more often in women than in men. It may appear in childhood. Frequently it is a sequel of dysentery or of some other debilitating condition. It is commonly associated with pregnancy. The native races of the tropics are far less liable to sprue than are persons of Furopear race residing in the tropics. Even though sprue houses in which successive tenants have suffered from this disease are known in India it does not follow that any specific indication 1 operative. In India and in Ceylon sprue occurs not only in the hot lowlands but also in the mountains at Considerable altitudes. Hild distribers of Similar tord develop particularly in Europeans resident in India soon after their arrival at a hill station. Although formely considered as a separate disease hill diarrhoes tends now to be regarded as an incipient state of sprue. It is followed not infrequently by typical sprue.

Europeans who have resided in the regions where sprice is common rather frequently develop the disease after returning to the United States or to Europe. The interval of time varies from a few months to fifteen states or even longer. The past bistory of many of those cases indicates that they had had dysentery diarrhoea or recurring gastro intestinal symptoms before the signs of sprue became characteristic.

ETIOLOGY

The etiology of sprue was for many years obscure Several investigators formerly believed a yeast (Wonda prilosis) found in the stools was the cause 1024 ETTOLOGY

Studies by Castle and his associates (1935) indicate that sprue is funda mentally a deficiency disease having features closely resembling those of Addison s anaemia According to Vedder (1940) sprue may develop in persons whose diet has been excellent. On the other band cases of sprue afford abundant evidence of defective absorption of food Castle believes (1935 p 72) that in sprue, as in permitious anaemia there is involved the failure of a reaction between an extrinsic factor in the diet, associated in several substances with vitamin B 2 (G) and an intrinsic factor present in the gastric contents of the normal person. In addition difficulty with the absorption of substances from the intestinal tract resulting from this hematopoietic reaction is probably involved in certain instances of both diseases. In different patients with sprue the relative importance of these mechanisms is variable. Sprue with macrocy tic anaemia thus an es from the variable participation of three defects of the extrinsic factor of the intrinsic factor and of absorption. Dietary deficiency of iron gastric anacidity and intestinal impermeability may also decrease the normal intake of iron The ' intrinsic factor of Castle is less frequently lacking in sprue than in Addison's anaemia

The dietary histories of many but not of all sprue cases indicate deficient ingestion of substances containing the extrinsic factor e.g. meateggs and whole cereals a disproportionately large ingestion of carbo hydrates and madequate consumption of fresh regulables and fruits

The specific infectious theory of the etiology of sprue which has had ardent advocates, is no longer tenable. It is his no means clear that year like organisms which may be found in the faces are even of secondary etiologic significance. Infectious diseases debilitating influences pregnancy, and many conditions which are associated with di orders of diges ition or of as imilation of food may serve as contributory or conditioning factors.

If sprue is essentially a deficiency disease indigenous cases might be expected to occur in almost any part of the world and there would seem to be no ground for recognizing categories based on geography. Probably, the more frequent occurrence of sprue in certain tropical countries is to be attributed to conditioning factors which are not yet fulls understood

Vedder's (1940) analysis of the causation of sprine is of great interest in this connection. He inclines to the belief that apprie develops only in predisposed persons and he suggests that displanction of the anterior pituliary gland may be intimately connected with the disturbed absorption from the intestine. Cases which are capable of response to diet are curable by means of a diet rich in the components of vitamin B : When the disease does not yield to diet it is because the necessary constituents of the food are not absorbed. Such cases usually respond to crude liver extracts administered parenterally. These crude extracts are rich in the factors included in vitamin B : Vedder pointed out that the faity diarrhoea of sprice may be expected markedly to reduce the absorption of the fat soluble vitamins A D K, and that of vitamin B is as well. Deficiency of these factors might account for some of the lessons which base

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been observed in sprue but deficiency of the constituents of vitamin B 2 appears to be of special significance

PATHOLOGY

Sprue causes no characteristic pathology The lessons seen at autopsy are usually indicative of the terminal stage of the disease. The tissues are wasted and dehydrated fat deposits are extremely depleted the liver is apit to be much reduced in size and change in the bone marrow are similar to those seen in Addision s anacemia and are often pronounced (Castle et al. 1935). Atrophic changes in the pancreas the kidneys or brown atrophy of the beart muscle have been observed.

It is believed that the small intestine may become thin walled pale and daphanous as a result of atrophy of the mucos and fibrons of the submucosa Inflammatory changes or irritative phenomena may be found in the tongue oesophagus or small intestine. They may be asso exated with round cell inflictation of the intestinal wall or with ulcerations which occasionally lead to perforation. Sometimes gray mucus is adherent to the surface of the gut and ocdema of the intestinal wall has been observed. Enlargement of the mesenteric lymph nodes pigmenta tion and fibrons have been reported. Some of the leasons of the mucosa formerly attributed to sprue are now regarded as post mortem changes.

Symptomatology

As a rule the onset is so in idious that it cannot be dated accurately but the attack may begin acutely with pronounced watery diarrhoea. There may be fever for a few days

Thereafter the temperature tends to be subnormal

The first symptom and sometimes the only sign noted by the patient may be sensitiveness of the longue or of the buccal mucous which is man fested especially when an alcoholic beverage or some acid or highly seasoned food is taken. At this time earlier or later lassitude anaemia mild gastro intestinal discomfort and morning diarrhoea develop. There may be alternating periods of durrhoea and constitution.

As the disease progresses the patient become's weak irritable and depressed and the gastro intestinal discomfort and gascous distention increase gradually. In advanced cases the complexion assumes a peculiar muddy pallor. The abdomes becomes distincted and takes on a doughy feel. The number of soft stools may increase to five or six daily and attacks of colo may be frequent. The history sometimes indicates that the symptoms are promptly aggravated by the consumption of carbo hydrate foods. Meanwhile the tongue becomes red angry looking and furrowed soreness of the mouth increases there may be burning pain in the oesophagus or in the epigratismum and ulcers may appear opposite to the molar teeth or under the tongue. In cases of extreme emacation active persistables of the small intestime may become clearly visible. Dur

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ing remissions the tongue becomes smooth and pink, soreness of the mouth disappears and all symptoms abate Rarely, soreness of the tongue may be the only symptom noticed

The changes in the blood are very variable. In the early stages of the disease and during remissions the color index is reduced and the blood changes are of the hypochromic type When the severity of the symptoms increases, the red cells become macrocytic and hyperchromic The pic ture may then he that of Addison s anaemia

Achlorbydria has been observed in from a quarter to a third of the cases studied Chemical analysis of the gastric contents is an inadequate index of the presence or absence of the intrinsic factor' of the gastric secretion (Castle et al 1935) The intrinsic factor may be present or absent, whether or not hydrochlone acid is present Signs of combined system disease analogous to those which may appear in Addison's anaemia are seen occasionally in sprue. In rare instances, they dominate the picture fetany may develop in sprue at any stage but especially in association with a downward course of the disease

The stools may be watery in the early stages of sprue In other cases they contain much mucus The typical sprue stool is gray in color, soft, full of minute (as bubbles sour smelling and abnormally voluminous Microscopic examination shows great excess of fatty acids soaps and some times of neutral fat as well The proportionate amounts of these constitu ents is variable. Muscle fibers may be seen but starch granules are absent Bile pigment is present in the stools in the form of leucobilirubin

The blood pressure is markedly reduced. It tends to decrease as the disease progresses and to rise with improvement Thayssen (1932) found that the hasal metabolism was frequently increased and sometimes con siderably increased but Suarez's (1038) observations in Puerto Rico were to the contrary. They both found the blood sugar curve ahnormally lon Similar changes but probably tending to be of lesser degree bave been observed in Addison's anaemia Tairley (1030) and others have noted reduction of scrum calcium in some cases of sprue and particularly in those having tetany. He reported phosphorus at the normal level whereas in parathyroid telany, phosphorus values are increased

Certain cases of "non tropical sprue present the typical symptom atology of sprue, but a large proportion of cases originating in the tem perate zone are atypical

DIAGNOSIS

Diagnosis is simple when the stools are characteristic anaemia present the tongue denuded and sensitive, and weakness and emaciation pro nounced Diagnosis may be difficult in mild cases, during remissions and in atypical cases The stools in Addison's anaemia are neither copious nor gray in color, emaciation is strikingly absent and the color of the skin is lemon yellow in contrast to the muddy discoloration seen in well marked cases of sprue Certain borderline cases however might be classified by

competent observers either as sprue or as Addison's anaemia. The spleen in sprue is not enlarged but in Addison's anaemia it is often palpable

In pellagra the lesions of the tongue the weakness the emaciation and the diarrhea may suggest sprue but the stools are neither fatty nor voluminous. In pellagra, the anaemia is seldom pronounced. It is still less likely to be of the macrocytic type There are borderline cases how ever which present some of the characteristics of both diseases and other atypical cases are to be regarded as instances of multiple deficiencies Roentgenological observations by Mackie Miller and Rhoads (1935) and others indicate that in sprue and in multiple deficiency states the activity of the small intestine becomes curiously irregular

Gee Herter disease or cochac disease usually seen in young children the idiopathic steatorrhoea of adults and atypical cases of non tropical sprue appear to be closely allied to sprue Fairley (1936) has stated that

In contra distinction to cochac disease and idiopathic steatorrboea hypo calcaemia in tropical sprue never leads to esteomalacia bony deform ity or spontaneous fracture. Furthermore gross osteoporosis must be relatively rare He attributes the hypo calcaemia of steatorrhoea and of sprue to defective absorption of calcium rather than to parathyroid disease and be quotes Linder and Harris (1930) who believed that defective absorption of vitamin D was the major cause of tetany in steatorrhoea The comparative rarity of bone lesions in cases of tropical sprue has been attributed to the beneficial effects of greater exposure to sunlight

Fatty diarrhoea may occur in gastrojejuno colic fistula or in pancreatic disease Thayssen (1032) says that the fatty diarrhoeas of pancreatic origin are usually associated with increased elimination of nitrogen in the faeces diabetic glycosuma or alimentary glycosuma and a blood sugar curve of diabetic type On the other band when there is byperchromic anaemia this is indicative of sprue

The atrophy of the muscles in general which is extreme in some cases of sprue occasionally leads to a mistaken diagnosis of progressive muscular

atrophy The atrophy in the latter disease is limited to muscle groups and the condition tends to be bereditary The emaciation of sprue some times leads to an erroneous diagnosis of cancer or of tuberculosis Intes tinal amoebiasis chronic bacillary dyseotery hookworm disease or tuberculosis may be associated with sprue

Prognosis -Mild cases of sprue respond rapidly to adequate treatment with liver extract Not only does the condition of the blood improve but the soreness of the mouth and the gastro intestinal symptoms quickly disappear Even in severe cases of long standing the improvement may be dramatic Unless adequately treated however severe cases are ultimately fatal within a period varying from about one to fifteen years

In cases in which the intrinsic factor has been absent it may reappear following liver therapy Unlike cases of Addison's anaemia which gen erally require maintenance doses of liver extract to prevent recurrence

sprue may be permanently curable

to 28 TRFATMENT

TPEATMENT

It is now well known that administration of liver extract not only benefits the macrocytic anaemia of sprue, but that the extract is capable observeming the mouth lesions and the gastro intestinal symptoms as well

Castle (1935) observed that oral administration of liver extract sufficed in some cases to control the lingual and gastro intestinal symptoms, but that in the majority of ca es improvement was not remarkable until after the extract bad been administered parenterally. His usual initial dosage of the extract v as the amount derived from so to 100 grams of liver given once a week or that from 10 trams injected daily. Vomiting or profuse diarrhoea were sometimes relieved within twenty four hours. Lingual symptoms were relieved and diarrhoea was usually controlled within a I pagastric distress and flatulence were correspondingly improved Within two weeks as a rule the stools were formed. Meanwhile the sense of well heing and the appetite were regained. Weight and strength increased gradually It was found however, that larger doses of the extract were needed in ome cases and especially in those of long standing Dosage must be adequate to induce initial improvement in each particular case A somewhat smaller maintenance dose administered once a week, may be required to prevent relap e. The variability of dosage required for individual cases is even more pronounced than in Addison's anaemia and the requirement is apt to be much higher in sprue

Parenteral rather than oral administration is the usual method of choice. Probably this method is necessary when the 'intrinsic factor' is lacking. The intrinsicing route has advantages when extract from as much as 100 Grams of liver is required daily. Fatbologic changes in the gastro intestinal tract resulting from extreme chrom ity of the disease of from complications, render treatment meffective in a few cases.

Diet—In ome cases of sprue the anaemia and other symptoms espond to dietary treatment alone, but it is believed but diet an only be effective in improving the blood picture when the intrinsic factor. It is present. Oral administration of liver extract will sometimes cause a retunilocyte response. More promounted effects are obtained by pare teral injection. The rise in the crythrocyte count in response to treatment is soldom as rapid as it usually is in Addison's anaema. As in some cases of Addison's anaema as in some cases of Addison's anaema as in some cases of the discount of iron. Cure of the anaemia so in certain cases of sprue there is a deficiency of iron. Cure of the anaemia in the cases is attainable only after the administration of iron in addition to liver extract. When hydrochloric and is locking it should be administered to the patient by mouth

Diet has been relegated by the newer methods of treatment to a post toon of lesser importance. However a high protein high vitamin non irritating diet containing little carbohy datae or lat may help to relieve symptoms before the specific methods of treatment have produced their effects. More or less dictary restriction can advantageously be continued in ome cases. Such restriction are necessary for some elderly

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persons (Suarez 1938) Persons who have recovered symptomatically from sprue as a result of treatment should be cautious as to diet and they may require a maintenance dosc of liver extract Neurologic symptoms like those of combined system disease when

present may be expected to yield slowly to hver therapy When there is tetany or osteoporosis calcium lactate and vitamin D are indicated

Persons who have contracted sprue in an endemic area and who return thereto must be closely watched because the chance of recurrence is con siderable (Miller and Barker 1937)

PRELENTION.

Owing to doubt as to the fundamental cause of sprue rules for prevention cannot be formulated with confidence. It is clear however that debilitating influences in general should be guarded against that digestive disorders especially dysentery should be treated promptly and effectively and that the diet should be well balanced and nutritious It should not contain an excess of carbohydrates It is believed also that adequate exercise taken regularly helps to maintain the digestive functions in a normal condition Harrison et al (1943) in pointing out that low levels of calcium in sprue are usual found serum potassium at very low levels in cases of sprue

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Addendum

In a review of the recent hierature on the subject one finds that the etvology oppose and teast some respects has not by the one definitely elucidated. The man point that have been particularly emphasized in the aprice syndrome are glossits steator those emarkation progressive ananema (assaid) mancrogric.) by peculiarlying some times achylas with loss of intrinsic factor hypocalcaemia a general avitamionis and sometimes page-matistion of exposed parts. Some observers beheve that there ensist no fundamental difference between tropical and nontropical sprine. However the number of cases of non tropical sprine so far described does not apparently permit of any generalization to this effect. Other authors have suggested that the pure syndrome may be evided from delayed cochact delease. Refinges fillowing (1941) from the study of the study of

Shattick (personal communication 1948) remarks that it seems probable that sprus it not exclusively a food deficiency disease ensumeds as it occurs early if at all myperal form in drags. It may have been probable that sprus it not exclusively a food deficiency disease ensumeds as the cut at a first a form in the probable and in the probable of the state of the probable of the state of the sta

Hote and Deucher from the study of 8 cases of non tropical sprue reported that the changes in the small intestune demonstrated by the radiological method are the result of intestinal burry and interference with the normal mump of the intestinal contests. Antogonins (1941) points suit that steatorchoes as no longer regarded as an explasation of dysfunction of the persponance atte appearance but rather as a daturbance of testify-

tion from the intestinal tract and that this is defined by 3 syndromes 1 Coeliac diseases—Gee Herter disease (ideopathic steatorrhoes) and aprile 2 Hypo- and

avitaminosis B, 3 Adrenal insufficiency (Addison s disease)

Oliters (1949) has carried on bactenologic investigations of the gastic mucosa spire by gastrosopic methods and found that in 94% of the spire cases the spire access to spire access to access to a spire access

in several recent publications has carefully considered the etiology of spine and the spine syndrome and critically reviewed the entire subject. He writes that it may be saumed that tropical sprine represents the fully developed picture of small intestine deficiency and is presumably due to previous damage to the intestinal mucosa. He writes that the mual lesson of sprine is confined to the small intestine is suggested by the disphanous appearance postmottem of this vacuus in advanced cases as well as the the abundantly proven chinacial observation of that addominal of stention is due to

affated coils of the intestine. He presents the hypothesis that gastro-duodenal inefficiency (and absence of intrinsic factor) is responsible for permitious anaemia that jeiuno ileal inefficiency is responsible for the sprue syndrome and that ileo caecal inefficiency is responsible for pellagra. He also points out that neither achylia gastrica nor hypochlorhydria is p esent as an invariable rule in sprue and that Castle found the intrinsic factor present in some even in cases with complete achlorhydria. Rodriguez Molina. (1941) found free hydrochloric acid present in the gastric juice in \$2 cases. Leitner (1042) points out that while it appears that gasting acidity has no definite bearing on the progress of the disease disturbances of gastric secretion are too frequent in sprue to be completely disregarded. He also remarks that it may be permissible to stipulate that there exists an additional unknown factor in gastric secretion and that in addition to gastrin (identical with hi tamine) a second gastric hormone has been prepared from the and extract of the pylone mucosa which exerts no effect on blood pressure pancreatic or bile secretion but when absorbed by the small intestine produces a gastric flow rich in acid but poor in pepsin Another significant fact has been demonstrated by Laurent and Sinclair who bave shown that vitamin B, may be destroyed in the stomach in achlorbydna

The normal and natural stimulus for the contraction of the vills and absorption is it issues which is extractable from the intestinal mucoss by hydrochloric acid to that it can now be stipulated with some confidence that some factor in the gastric juice usually combined with hydrochloric acid is jointly responsible not only for the movements of the vijih but also for the preservation of virtumi B. The permeability movements of the vijih but also for the preservation of virtumi B. The permeability movements of the vijih but also for the preservation of virtumi B. The permeability movements of the vijih but also for the preservation of virtumi B. The permeability movements of the vijih but also for the preservation of virtumi B. The permeability movements of the vijih but also for the preservation of virtumi B. The permeability movements of the vijih but also for the preservation of virtumi B. The permeability movements of the vijih but also for the preservation of virtumi B. The permeability movements of the vijih but also for the preservation of virtumi B. The permeability movements of the vijih but also for the preservation of virtumi B. The permeability movements of the vijih but also for the preservation of virtumi B. The permeability movements of the vijih but also for the preservation of virtumi B. The permeability movements of the vijih but also for the preservation of virtumi B. The permeability movements of the vijih but also for the preservation of virtumi B. The permeability movements of the virtual statement of the preservation of virtumi B. The permeability movements of the virtual statement of the preservation of virtumi B. The permeability movements of the virtual statement of the preservation of virtumi B. The permeability movements of the virtual statement of the preservation of virtumi B. The permeability movements of the virtual statement of the preservation of virtumi B. The permeability movements of the virtual statement of the permeability mov

of the epithelium of the villi is also an important factor

Letter has critically reviewed the hierature and the physiology of the small intration in its application to the enology of sprue and his article should be consulted by all those especially interested in the subject. In his conclusion he has expressed the following views as an explanation of the chain of events invol ed in the mechanism of the sprue syndrome.

s Primary Cause - Breakdown of normal absorption in the upper part of the small intestine (due to different causes)

3 Secondary Cans 1 - Deficiency in gastric secretion and hydrochloric acid neces

sary for con dination of intestinal functions
3. Achiothydria which affects motility of the vill and decreases the vitamin B content of food

4 Stagnstion and malabsorpt on which produce abdominal discomfo t and flatulence

5 is a consequence of achierhydras migration and multiplication of intestinal flora (B et ce)

6 Consequent breakdown of iron metabol sm in relation to bone marrow and

baemoglobin producing megalocytic anaemia

7 H emoglobin metabolism perverted to increasing amounts of purphy in

8 Bil rubin excretion reduced bihrubin serum content increased

9 Follow g liver damage bile acids dec eased to turn reducing hydrotropy and

fat absorption

Our colored fatty acids in the small intestine forming insoluble calcium salts this affects the bones and then the whole elect ob the equilibrium

Development of this

stage is slow and may last years

11 Increasing I ver dysfunct on excess ve porphyrinuma whereby Meissner's

pletus is p ralysed motility of villa is disturbed. Breakdown of cytochrome enzyme system and steatortheea. Ta Owi g to already present dysfunctions an acute vitamin B deficiency is thereby

produced

The clinical manifestations resulting from this auccessive chain of events may eventuate in spruc or possibly in pellagra. Stantius (riger) has written a critical review of great the pathogeny and made observations for further investig to s. If a art cle published what this book is mp ess should be

for further investig to s. It's art cle published what this book is un p eas should be studied by all those intersted in the subject. He considers the primary failure in sprue is one of pho phosyl to the easil of defective on you act n and th t sprue is Proper by placed atmosp the done on of mainstration. For reference to addendum we p 1 mg) For critical over sew of the laterature—see Stammus To s Rey See Trop Mid & Higs. December 1942

Clapter XXXII

DEFICIENCY OF VITAMIN A, THE VITAMIN B-COMPLEX

Definition —Deficiency of stamm A is manifested especially by lesions or disordered function of the eye and by changes in the skin and in growing teeth Yerophthalmia keratomalacia night blindness and comincation of epithclial structures are among the characteristic lesions caused by deficiency of stramm A

Vitamin A.—The several carotenoid pigments which are included under the ame of carotene are yellow or red in color. They are synthesized by plants and in the animal body they are conscrible into vitamin A Carotene is also called provitamin. Beta carotene is used as the basis of the international unit because of its superiority as a source of vitamin A it is stored in the body both as provitamin and as vitamin A.

Incidence—Recognizable signs of vitamin A deficiency are by no means uncommon in infants and in young children. In adults well marked cases eem to be infrequent, except that regional outbreaks have occurred when groups of people have been subjected to such dictary privations as may occur in time of famine or in war. Saliors prisoners and laborers in India and elsewhere have been afflicted as have individuals when subjected to dictary restrictions. Infectious diseases gastro intestinal diseases disorders of fat absorption diarrhoea or advanced disea e of the liver may interfere with absorption of vitamin A and may thus cause signs of deficiency to appear

The true incidence of vitamin A deficiency is not known. Probably the lesser degrees of deficiency are common and widespread in the Tropics and elsewhere. Vitamin A deficiency should be looked for wherever mainturition exists. As a rule it is associated with other kinds of nutri tropal defects.

ETIOLOGY

Vitamin A deficiency is caused by deficient in, estion of food containing vitamin A or the carotenoid pigments from which vitamin A is derived or from failure of the body to absorb and to utilize these substances Normal bile being concerned with the absorption of fats probably ands the ab orption of vitamin A from the intestine Advanced liver disease may interfere with storage of this vitamin. Rapid growth pregisancy, fever and other conditions which increase metabolism enhance the requirement for vitamin A. The carotenemia which has been observed in the blood of diabetics by Brazer and Curtis (1940) may be due to mability of the body in these cases to convert carotene into vitamin A.

Liquid petrolatum ingested in therapeutic dosage absorbs carotene from the food content of the intestine (Curtis and Ballmer 1939) unless it has been previously saturated at body temperature with carotene. The same may be true of other fats and oils which normally contain little or no carotene. The etiological implications of these facts seem to be significant.

Physiology —Vitamin A is necessary for vision for the maintenance in normal condition of various epithehal structures including the teeth for storage of fat and for growth

In the even vitamin A is needed not only for the formation of visual purple but also to prevent degeneration of the cornea and other parts of the eye Deficiency of vitamin A causes defective or delayed formation of visual purple

The human body has considerable power to store vitamin A. The liver is the principal reservoir. At birth, the liver contains little of this vitamin hull it tends to accumulate with advancing years. Cow's colostrum has an extremely high vitamin A activity and human colostrum is about three times as active as is human mill. Thus the infant is normally provided with large amounts of vitamin A at the time when hitle of it is present in the liver. Aborption from the intest is variable and by no means complete. Apparently vitamin A is not normally excreted in the urine but it is present in the circulating blood.

PATHOLOGY

The pathology of vitamin A deficiency has been described in detail by Bessey and Wolbach (1938) Effects of deficiency of vitamin A are main fested in many epithelial structures The characteristic changes are altrophy of epithelium probleration of basal cells and consequent formation of stratified keratanized epithelium. The changes are identical wherever they occur.

In man the lessons of epithelal structures are found in various parts of the eye in the ename I forming organ of the teeth the nose and accessory snuses the trachea and bronchi the renal pelves the bladder the prostate gland the uterus the testes the sweat and sebaceous glands: the harr follicles and the skin. The pancreas the lacrumal glands and perhaps the salvary and partid glands may be involved. Analogy suggests that lesions of the gastro intestinal mucosa might result from deficiency of vitamin A.

Loss of body fat retardation of growth haemosiderosis of the liver and spleen and atrophy of the bome marrow associated with anaemia limph oid hypoplasis of the spleen and degeneration of skeletal muscles may be found in vitamin A deficiency but they are not specific lessons. The lesions of vitamin A deficiency are usually associated with signs of deficiency of other frood factors.

Wolbach does not believe that there is any clinical evidence of the production of neurological lesions in man as a result of deficiency of

Person I commun cat on Octobe 940

vitamin A. On the basis of work done in his laboratory, he has reached the conclusion that it is impossible by a diet deficient in vitamin A to produce neurological lesions in animals approaching adult size. Wolfard and Bessey (1940) have reported that in growing rats during the first few weeks of life deficiency of vitamin A can stop the growth of bone. Lesions of the nerve roots then follow as a result of overgrowth of the central nervous system.

PANALOTATOFORA

Eyes —Hemeralopa is an early sign of deficiency of vitamin A. This disorder is manifested by defective vision in subdued light or by delayed adaptation to subdued hight or ratter exposure of the eves to highly light. The symptom indicates delayed or defective formation of visual purple. Conjunctivitis itching and burning of the cyclids and photophoba and cates a later stage of the disorder. Some authors perhaps erroneously have attributed like symptoms to inholdran deficiency (p. 1945). Still more advanced cases show dryness and reduced sensitivity of the cornea and of the conjunctiva (xerophthalma). The cornea may show light brown pigmentation, the hids may twitch and the patient may see dancing specks or glittering images. Finally Bitot's spots, which resemble flecks of dired foam, may appear on the cornea or softening and ulceration may occur (keratomalacia). Permanent damage to the eyes and even blind ness may result. Levons are blaterial as a rule.

Teeth - Damage to the enamel forming organ disturbs the formation of dentine so that growing teeth become soft or develop abnormally

The skin is abnormally dry and rough. The roughness is producted by cormification which occurs especially around the hair follicles on the extension and outer surface, of the arms and legs. This feature is far more common in adults than in infants. There may be generalized pigmentation of the skin. Americorm cruptions are common. Changes in the bair and in the pails have been reported.

Other signs and lesions which have been attributed directly or indirectly to deficiency of vitation A include dryness of the mouth simustic dry cough bronchectasis bronchal obstruction and articlesas deficiency of gastric hydrochlone and digestive disconfiort diarrboca, byelo nephritis cystitis prostatitis abortion testicular atrophy, nervousness and neurologic lesions involving the legs and causing more or less dischility. The growth of children is stunted. A deficiency of vitamin A has been suggested as a tactor in the production of lathyring (p. 1203).

It is doubtful whether neurologic lesions in man are ascribable to deficiency of vitamin A slone. If so they are most likely to be lound in infants and children when growing rapidly (p. 10xe). Probably there as relationship, in some cases between stone formation in the genito unnary tract and vitamin A deficiency. Observations made in Java support this

Pneumonia is a common cause of death in infants who have vitamin A deficiency Various other infectious processes are frequently associated

with deficiency of vitamin A — It appears that this deficiency may become a contributory cause of infection by damaging epithelial structures

DIAGNOSIS

The presence of hemeralogus or of the more characteristic lesions of the per should lead to the suspicion of virtamin A deficiency. Hemeralogua can occur however in connection with sarous other diseases of the eje. It cannot be detected in infants and in young children. A useful sign of virtamin A deficiency in them can be elucted by retracting the lish for five minutes. If the cornea then becomes dry and granular in appear ance this is a sign of virtamin A deficiency. Keratinized epithelial cells may be demonstrable by wiping a spatula gently across the cornea and then staining the cells so strayed off. Keratinized epithelial cells may also be found in scrapings from then one of the wagin so or in the urine

Photometric evaminations of eyes have been extensively used for recognition of the earlier stages of hemeralopsa Decause the margin of variation in normal individuals is large such evaminations seem to have a limited value for diagnosis. This test and other features of vitamin A

deficiency have been discussed in detail by Jeghers (1037)

Hemeralopia is usually the earliest recognizable sign of vitamin A deficiency. The visible leavons of the eya appear at a later stage. Dry ness and roughness of the skin with or without itching is suggestive but papular comification of the skin about the hair follicles has been described as characteristic by several observers. It is said to occur especially on the extensor surfaces of the extremities or over the shoulders. To differ entate between these follicular lessons and those commonly seen in scury might be difficult were it not for the fact that they are usually associated in scury, with petichal hemorrhages. Echiman and Rapport (1940) studied the cutaneous manifestations of vitamin A deficiency in children Their misestigations indicated that so called kertatoss pilaris lichen plains liches spinulosis richyoas follicularis and other synonyms are merely descriptive terms for manifestations of vitamin A deficiency.

Information should be obtained about the diet of the patient with special reference to foods containing vitamin A. It should be known whether the patient has or has had any disease which interferes with absorption of food. In this connection diseases of the liver or the pan creas sprue and persistent diarrhoes or vointing are especially important. Chronic wasting diseases and cases of acute illness such as typhus or typhoid feer when severe restrict the ingestion and absorption of food and can lead to keratomalacia which is dependent probably on deficiency of vitamin A.

Methods for estimating the carotene and vitamin A content of the blood plasma seem to be of httle value for diagnosis

TREATMENT

Diet. -- Because vitamin A deficiency is generally associated with signs of deficiency of other food factors treatment should include a halanced

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diet, rich in all known food factors. Resistance to infection is believed to be increased by administration of vit min A, only when the supply of vitamin A in the body is madequate.

Sources —The richest sources of vitainin A are the cod and especially the halibut liver oils. Carotene is abundant in most of the green leafy vegetables and in some of the yellow or red vegetables and fruits. There is a good deal of it is milk butter, cheese, egg yolk and fresh yeast. In addition to their varying content of carotene milk, and batter contain vitainin A which is coloriess. Therefore, the color of milk, is not an indeed of its value as a source of vitamin A. Hutter usually contains artificial coloring matter.

Carotenoids and sitamin A are soluble in fats and oils. The activity of vitamin A or of carotene is rapidly destroyed at high temperatures by an oxidizing agent. This point is well known to manufacturers of canned foods. Many such foods as marketed today, are believed to be valuable sources of vitamins. Dired or dehydrated foods are relatively deficient in vitamin A. Red palm oil an important article of diet in parts of Africa is rich in carotene.

Dosage —The minimum daily requirements for vitamin A are not accurately known Booher (1938) believes that 6000 to 8000 units of vitamin A (USP) or international Units) should be provided for the growing child. She recommends 3000 units or more for pregnant and nursing women. Visual actual in adults has been restored in the or three weeks by daily administration of the carotene equivalent of 10 000 units of vitamin A (Jeghers 1937). Concentrated solutions of carotene in 1940). The optimium dowage of carotene and of vitamin A is uncertain 1940). The optimium dowage of carotene and of vitamin A is uncertain 1950es (1938) has used up to 5000 units in the form of concentrates Visual disturbances may respond rapidly to treatment but the skin fessons may nersist for 4 to 14 weeks (10 uninas) and Corletter 1931.

Absorption of fat seems to aid in assimulation of errotene. Conceredy, a diet too low in fat or deficiency of bile in the intestine may reduce absorption of carotene. Steatothea from any cause bilary obstruction and the taking of liquid petrolatum may interfere with the absorption of carotene and of vitamin A. It is probable that the ultivation of carotene and of vitamin A may be disturbed in severe cases of liver disease. When the normal flow of bile into the intestine is reduced bile should be administered to the patient. When factors are present which may operate against absorption of carotene larger dosage of carotene or of vitamin A is indicated.

Toncity—Evidence is lacking that vitamin A, per se, is tout to man or animals, but experiments on animals indicate that cod liver oil green in considerable dosage is toue for certain kinds of animals and perhaps for man. Muscular distriphies and degeneration of the heart muscle have been attributed to constituents of the oil. Until more is known about this matter some caution in the use of large and repeated doses of highly concentrated preparations of liver oil would seem to be advisable. Yeast and natural foods are believed to have some protective action against the toxic substances of fish liver oil Clausen (1038) has discussed the question of toxicity of vitamin A preparations

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THE VITAMIN B COMPLEX

Dr Otto A Bessey has kindly prepared the following statement about the Vitamin B Complex

The term vitamin B complex refers to a group of water soluble

dietary factors (vitamins) which have become grouped under one term as a consequence of historical development and because of their similarities in properties and occurrence together in yeast and liver

Confusion in terminology has developed due to the rapid progress in investigative work in this field and the subsequent unexpected multiplicity of factors Different terms have been applied to newly discovered factors and specific terms became entrenched in the literature before the existence of separate entities was established The terminology which appears in publications dealing with these factors and its meaning will vary depend ing on the country from which it came and the time at which it was written

Soon after attempts bad been made to determine the nature of all dietary essentials necessary for the rat McCollum (1916) proposed the name water soluble B for a newly discovered factor and presented evi dence that it was similar to the antiberibers factor that Eighmann (1897) had previously shown would prevent experimental polyneuritis in birds In 1920 Drummond suggested that the term vitamin (previously coined

by Funke) with qualifying letters, should be used to designate the mem bers of this rapidly growing list of dietary essential factors until such time as the factors could be isolated and identified as pure chemical compounds It was soon found that the factor which had been designated as vitamin B was multiple in nature a heat labile fraction contained the anti neuritic factor while both this and a heat stabile factor were necessary for growth in the rat At about the same time (1925) Goldberger and Tanner showed that pellagra was due to a dictary deficiency and could be prevented by a heat stabile factor present in the yeast. This factor had properties similar to the heat stabile rat growth factor. They pro posed the name pellagra preventive factor (P P Factor) for this dietary essential This term was generally used until 1937 after which time it was gradually replaced by 'nicotinic acid which had been identified as the principle chemical entity in question. It had been found that micotimic acid also prevents black tongue in dogs thus establishing the correctness of the early assumption that this disease in the dog corresponds to pellagra in man

In 1927, the British Accessory Food Factors Committee proposed a system of nomenciature in which the term 'vitamin B' was to be used for the developing complex vitamin B to the antineuritic factor and vitamin B 2 for the more heat stabile part of the complex As evidence for other factors appeared, they were designated as vitamin B 3 vitamin B 4 vitamin B 5 etc.

A committee on Vitarin Nomenclature of the American Society of Biological Chemists recommended in 1929 that the term vitaring B be used to designate the antineuritie factor and vitaring G be used to designate the heat stabile fraction of the complex. The use of the term vitaring G' has been confined almost exclusively to the American Iterature. The terms vinamin G' or vitaring B 2' have been used.

in some instances in reference to the pellagra preventive factor

Kahn (1933) demonstrated that lactoslavin a vellow heat stabile upment present in many natural products including yeast and liver was necessary for growth in the rat. Additional evidence showed that it was this factor which had been measured by rat growth methods as 'vitamin B and the stable of in America and vitamin B and Great Britain. Vitamin B a has sub sequently been used extensively in the German and in the British literature as a designation for this factor. In America the term vitamin G' has been used. In 1937 the American Committee on Nomenclature recommended that this factor be designated as riboslavin and that the term vitamin G or vitamin B a be no longer used. This committee also suggested that the antineuritie factor be known as thumin or vitamin B and that the term vitamin B without a subscript be no longer used. Many European publications have used the term ancurn in reference to the antineuritie factor.

Thiamm (heat labile), riboflavin and nicoting and (heat stabile) are pure chemical entities of established importance in human nutrition Evidence for the existence of a number of additional heat stabile members

of the B complex has come from separation procedures on liver and yeast and from the response of rats pigeons chicks and dogs to these fractions and to treatment with various types of experimental diets Undoubtedly many of these factors will be shown in the near future to be important in human nutrition

Vitamin B 3 and vitamin B 5 are designations of supposed growth factors for the pigeon

Vitamin B 4 a heat labile factor supposedly associated with specific paralytic symptoms in the rat and chick

Vitamin B 6 (factor) adermin) a pure compound which prevents a dermatitis in rats and an anaemia in does

Pantothenic acid (filtrate factor) a pure compound which prevents a

dermatitis in chicks and is a growth requirement for the rat Gray hair factor denotes a fraction which prevents the development of

gray hair in rats foxes and other ammals kept on certain experimental diets Factor W designates a supposedly necessary growth factor for the rat

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Chapter XXXIII

BERIBERI

Svnonyms — Polyneuntis Findemica Barbiers Kalvlé (China and Japan) Maladie des Sucrenes (Trench Antilles), Hinchazon (Cuba) Inchagao or Perneiras (Brazil) Maladie des Jambes (Louisiana), Alcohole Neiribie

Definition—Beriberi is a disease of nutrition which is attributed to inadequate ingestion absorption or utilization of the heat liable portion of the vitamin B complex which is usually designated as vitamin B r or as thiamin Typical cases are characterized by neurological lesions involving particularly the peripheral nerves of the limbs or by acute congestive failure of the heart which develops in the absence of lesions of the valves, hypertension, coronary disease or of pronounced changes in the myocardium

Fistory —Benbert has long been known in parts of the tropics and subtropics. It so occurrence, in modined form among fishermen and sailors on the high seas was recognized a generation ago. The discovery of benbert in Newfoundland in 1914 has proved that this disease could develop in a cold climate. Evidence which has accumulated during the past ten jears indicates that "alcoholic neuritis is to be regarded as benbers in the alcoholic subject and that benbers may be conditioned by a consider able number of other diseases or circumstances in which nutrition is disturbed.

Geographical Distribution —Benberi has been particularly prevalent in southern China Japan Malaya the Dutch East Indies and the Philippine Islands Notable outbreaks have occurred in Brazil, in other tropical parts of South America and in Africa Main cases occurred in a garn on Puerto Kico in 1918 In 1928 numerous cases of beribert were recognized among rice farmers of Louisiana. The incidence and distribution of sporadic cases in the temperate acones is imperfectly. Anown

A good many years ago benben virtually disappeared spontaneously from the Amazon Basia. More recently the application of effective methods of prevention has greatly reduced its prevalence in the Far East.

Incidence—Race, age and sex have little if any influence per se on susceptibility to beriber: Outbreaks of the disease have been associated at times with insanitary conditions in garrisons prisons asylums and on ship board. An epidemic of infectious disease may condition an outbreak of berber: In South China and its some other localities beribers prevails particularly under ecosonal climatic conditions which are characterised by best and humarity. It

would be rash to assert that chinatic conditions have no direct influence but it is more probable that coincident modifications of diet are of greater importance

An ill balanced diet in which polished rice or other starchy food pre dominates is responsible for most of the cases of beriber. In Newfound land particularly during the winter months white flour plays a rôle like that of polished rice

ETIOLOGY

Vitamin B 1 — It is generally believed that the more characteristic symptoms of benben are caused by deficiency of vitamin B 1. Such deficiency may be brought about by inadequate ingestion by defective absorption and probably by metabolic disorders which interfere with utilisation of the vitamin after absorption from the intesting.

The requirements of the body for vatamin B: increase with the metabolic rate and with the caloric value of impested food. Among conditions which increase the need for vatamin B: are arduous work. Februle diseases hyperthyroidism pregnancy and lactation. Absorption may be seriously imparted by continuing diarrhoea by lesions of the gastro intestinal tract or by short circuiting operations which involve the unestimal tract. Advanced disease of the liver probably restricts the

storage and utilization of vitamin B i

Ineadequat ingestion of vitamin B 1 may occur in connection with a great variety of conditions which may lead the patient to subsist on an ill balenced diet. These conditions include certain racial habits poverty chronic alcoholism vomiting of pregnancy, cancer of the gastro intestinal tract tuberculosis persistent anorevia dietary fadam and unwise them peutic restriction of det: Beriberi in nursing infants is caused by deficiency of vitamin B 1 in the breast milk and this in turns due to deficiency of vitamin in the due to the mother or the west murse.

Not all the 5 mptoms which occur more or less frequently in beribert can be attributed to deficiency of vitamin B 1. In at pical cases some of the symptoms are caused by deficiency of other components of the vitamin B complex or by deficiency of other components of the vitamin B complex or by deficiency of other important food factors. Protein deficiency for example may be a factor in the causation of oedema. There are numerous cases of combined deficiency in which signs of defi-

ciency of vitamin B 1 may be either dominant of mapparent. While granting that the polyneurities associated with alcoholism pregnancy and gastro intestinal disturbances is due to nutritional deficiency and that it is in every way similar to Oriental benthern Meisleigholi (1936) believes that the exact sature of the deficiency causing nutritional neurities remains obscure. He said that it has not been demonstrated that this polyneurities disturbed that they benther is caused by deficiency of \(\nabla\) and that wet benther is caused by deficiency of \(\nabla\) and that vet benther is caused by deficiency of \(\nabla\) in and that wet benther is caused by deficiency of \(\nabla\) in the said that it is polyneurities. When the said that the prevention of the said that the prevention of \(\nabla\) and that the prevention of \(\nabla\) is and that a diet evelwavely of polished rice is as deficient in the vitamin B \(\nabla\) and that the preventions and the said of \(\nabla\) is a said that a diet evelwavely of polished rice is as deficient in the vitamin B \(\nabla\) and that the preventions and the said of \(\nabla\) is the said that the prevention of \(\nabla\) is an all that the preventions.

1040 FTIOLOGY

degeneration of beribers may be due chiefly to deficiencies of vitamin A and of the B $\,$ complex

There are still a lew persons who cling to the idea that beriber is caused primarily by an infection. The experimental investigations of Friser and Stanton (1917) in Malaya and of Strong and Crowell (1913) in the Philippines demonstrated very conclusively the deficiency nature of the disease in man. In the latter investigations in which beribers was produced by feeding deficient diets to individuals carefully isolated through out the experiments not only was its nature shown but also it was conclusively demonstrated that the disease was not an infectious one. The presistence of the view that it is infectious can be explained on the following basis. It is known that large numbers of people particularly in the tropics subsist on diets which are barely adequate under ordinary circumstances to prevent the development of beriber. When in such a group an outbreak of infectious disease occurs the requirement for straim B is is thereby increased. If the infection causes diarrhoea absorption of the vitamin B is thereby increased.

The theory that beriben is caused by a toxic substance which develops in damaged rice, seems to require no more than passing mention. How ever, rice which has been stored for a long time may deteriorate. The

growth of fungi in such rice reduces its vitamin content

PHYSIOLOGY OF VITAMIN B 1

Cowgill (1939) has evaluated the recent studies on the physiology of vitanin B 1 Williams and Spies (1938) have dealt with the subject in greater detail

Storage—The capacity of the body to store vitamin B r is relatively immited. In experimental animals signs of deficiency may be produced within a period varying from ten days to three or four weeks. Clinical experience indicates that symptoms may appear in man after a few weeks of inadequate diet. Doubtless this period is lengthened when the degree of deprivation is relatively slight. Complete deprivation of vitamin B is a stored in the hear and in the kidneys. It is nearly as abundant in the normal heart. Even in fatal cases of manifest deficiency of vitamin B r some of the vitamin can still be demonstrated in these organs.

Vitamin B r is readily absorbed from both the small and the large intestine Diarrhoea reduces markedly the absorption of vitamin B r It seems probable that the vitamin B r which has been demonstrated in

the faeces is synthesized there by certain bacteria

Excretion—Vitamin B 1 is excreted in the urine and in human mulk in amounts which vary with the diet (Cowpill 1935) Harris and Leong (1936) believed that a daily exerction of less than 12 I U of vitamin B 1 in the urine is presumptive evidence that the diet is deficient in this vitamin

Functions of Vitamin B x—Disorders of gastric secretion peptic ulcer alterations of motility and tomus of the gastro intestinal tract and certain cases of chronic colitis have been attributed to deficiencies of parts of the vitamin B complex. It does not seem possible as yet to decide whether deficiency of vitamin B x alone can cause any of these conditions. Anor cua and other mild digestive disorders are frequently attributed to deficiency of vitamin B x.

The normal heart is not influenced by administration of pure vitamin B 1. Therefore no beneficial effect is to be expected from the use of this

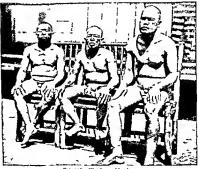


Fig 226 -Wet form of b

vitamin except in the presence of deficiency of this substance. The disorders of the circulation referable to vitamin B t deficiency are discussed under Wet Beriberi (p. 1045).

Widespread degenerative changes which may occur in the nervous system have been attributed to deficiency of vitamin B 1. The lesions are not specific in character. A number of clinical varieties of neurological degeneration, which were formerly ascribed primarily to some tonic or infectious agent, are believed now to be caused essentially by deficiency of vitamin B 1. These conditions are discussed under Dry Beriberi (p. 1044).

Investigators agree that vitamin B r plays an important rôle in the intermediate carbohydrate metabolism Any condition which increases

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the metabolic rate requires an increased amount of vitamin B 1. A diethigh in starches, sugar, or alcohol enhances the requirement. Fats seem to have a sparing action for vitamin B 1. The nature of the relationship of vitamin B 1 to the metabolism of fat, however, is still undetermined Feters (1936) and his associates believed that vitamin B 1 functions as a co-enzyme in the metabolism of carbohydrates and that it plays a part in the oxidative break down of pyruvice and. Accumulation of pyruvice acid or pyruvates in the blood and in the cerebrospinal fluid and excess of them in the time seem to be related to deficiency of vitamin B 1. This training is extended by neight Libido is often decreased and the chances of pregnancy are reduced by deficiency of vitamin B 1. It seems highly probable that the functions of various glands of internal secretion are disturbed by lack of vitamin B 1.

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Heart—Vedder (1938) has said that deaths from beriber are due to cardiac hypertrophy followed by sudden dilatation and cardiac failure rather than to lesons of the nervous system, however extensive. The dilatation usually involves chiefly the right ventricle and the right auricle he left eventricle may be dilated or contracted. The size and weight of the heart is considerably increased. Microscopic examination of the heart muscle has revealed fragmentation fatty degeneration, and hydropic degeneration of muscle hors. Vedder attributed the fragmentation to post mortem changes. In Java Wenckebach found hydropic degeneration without evidence of true hypertrophy of the muscle fibers. He believed that the leasons which he observed were characteristic tor beriber. We said Wilkins (1936) observed symbiar lessons in cases of vitamin deficiency in Boston but they found lessons of the same character in some of the control cases. The cardiac pathology thus far described seems inadequate to account for deaths of cardiac organ.

Pathology secondary to cardiac insufficiency includes pulmonary ocdema passive congestion of the liver, spleen kidneys and intestine accumulation of find in serous cavities and dependent ocdema. The ocdema may be generalized but it seldom involves the face. Punctate hemorrhages are not uncommonly found under the pleura in the stomach and in the duodenum.

Nervous System —The fessons in the nervous system in benderi show the characteristics of a degenerative process. Signo of inflammation are absent. Whereas the term neuritis implies inflammation the term neuropathy proposed by Wechsler is more applicable to the neurological lessons of berbern. Neuropathy may be demonstrable in any of the peripheral nerves in the cord and spinal ganglia in the nuclei of the medulia and the poins in any of the cranial nerves or in the sympathies sistem. Among the peripheral nerves the sciatic is apt to be involved early and to show relatively advanced lessons. The cranial nerves most frequently involved are the vags and the phrenics.

The membranes of the spinal cord and brain may show congestion Degenerative lesions are seldom demonstrable in the cord except by micro scopic examination. The attentor and the posterior nerie roots and the motor and sensory tracts of the cord may be involved. Changes in the cord are apt to be more pronounced in the posterior cordiums and in the nerve roots than elsewhere. Vedder (1938) emphasized the important fact that the splanchme nerves the renal pleuses and the branches of the cardiac and of the solar plexuses may show degenerative changes.

Lesions of the axons may lead to or be concomitant with lesions in the cells from which they spring The degree of the degenerative lesions



Fig 27—Human b iber S tenra showing dig rato fmy in h il mit tipla cell tion glibut with som f gm nitat n fnerve fib thim ly (St g nd C ow 11)

depends largely on the duration of the disease. The microscopic lesions of the a vis cylinders consist of destruction of the sheathes with or without fragmentation of the fibers. The nerve cells may show signs of atrophy In cases of short duration. Jesions of the nervous system may not be demonstrable even by histological examination. Usually the degenerative changes in a nerve are limited to some of its fibers but an entire nerve may be destroyed. In chronic cases some of the nerve cells may die. Dead nerve cells cannot be regenerated so that irreparable disability results.

The muscles supplied by the damaged nerves show more or less atrophy. Neither the atrophic changes in the muscles nor the degenera tive lesions of the nerves in heriben show any characteristic features which are peculiar to that disease.

SYMPTOMATOLOGY

The onset of beriheri may be fulminating rapid or gradual. Non fact cases may become chrome. Relapses and recurrences are common. Among the permonitory signs and early symptoms of beriberi are marked general weakness, loss of appetite and vague symptoms suggesting neuras thema. Usually the temperature and the white count are normal. The urine is negative. By the time neurological symptoms appear the tendon reflexes of the affected limbs are reduced. These reflexes may be lost are a later stage. Tachycardia and enlargement of the heart usually appear.



Fig 228-V: mn B (th mn) deficency Scatcherve fing on Advanced deg vication of nerve fibes (Prepa ats n f Dr R L Swank Courtesy J. E per Med)

early Slight anaemia due probably to iron deficiency, is not uncommon In typical cases the spinal fluid is negative throughout the disease Serum proteins are sometimes diminished. Probably this change should be ascended to coincident protein deficiency. For convenience of descrip tion several forms of the disease are recognized dry beriber web beriber, atypical beriber and infantile beriber. Cases of intermediate or mixed forms are common.

Dry benben is characterized by more or less definite signs of neurop actly. The onset as a rule is insidous. Weakness of the leg muscles is so often an early symptom that the squatting test has been recommended for diagnosis. In more advanced cases the drop causes the steppage gait and finally walking may become impossible. Weakness and atrophy of the muscles develop coincidentally. Sensory disturbances are usually

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associated with the motor symptoms but the disorders of sensation are seldom as prominent as are the motor symptoms. Among the common sensory symptoms are formication and hyperesthesia or blunting of sensa tion When the disease progresses the arms usually become involved in like manner In well marked and typical cases the picture is that of flaccid atrophic paralysis with or without cardiac enlargement and per sistent tachycardia. Gradual recovery of injured nerve cells and slow regeneration of damaged neurons occurs in most cases When improve ment has been delayed until after the death of some of the nerve cells complete recovery is no longer possible

Wet Beribers -Fulminating cases are not rare They give the picture of congestive heart failure. Usually the onset of cardiac symptoms is



U m r)

rapid. The patient may first notice increasing weakness and a sense of fullness or of pain in the epigastrium Tachycardia and cardiac enlarge ment are present. Even slight exertion may produce dyspnoea. At about this time oedema of the fect and ankles appears As symptoms increase the epigastric pain tends to become severe dysphoea is followed b) orthopnoea with cardiac dilatation and pulmonary congestion the liver becomes enlarged and sensitive to pressure. Oedema increases markedly. It may become extreme but it seldom involves the face Serous effusions are common but they are difficult to recognize in the presence of marked cardiac dilatation and extensive oedema Systolic blood pressure falls. The urme becomes scanty but contains little albumen Sudden vasomotor collapse may occur More or less definite signs of neuropathy can usuall ybe elicited by careful examination Pronounced muscular wasting may be masked by oedema

In cases which recover the oedema disappears more or le s rapidly The excess of fluid is eliminated by diuresis. The picture may then become that of dry benbers

The mechanism of the circulatory disorders of beriberi is still uncer For many years the cardiac disturbances were ascribed to lesions of the vaga because demonstrable cardiac pathology appeared insuffic ent to account for them But Wenckebach (1934) believed that disfunction of the vaga could not explain the cardiac symptoms. He ascribed them to oedema of the heart mu-cle with resulting loss of contractility. Weiss and Wilkins (1936) found similar changes not only in circulato y disorders which they attributed to deficiency of vitamin B I but also in control cases in which they believed that no such deficiency existed. Their data indicate that not only the heart but also the peripheral circulation may be at fault. It has occurred to me that lessons of the sympathetic nerves may perhaps play a part in the causation of the peripheral vascular phenomena

The conclusions reached by Weiss and Wilkins (1937) in a subsequent paper are so illuminating that they are quoted in full

t Dysfunction of the cardiovascular system reulting from unbalanced food intake is a di case of regular occurrence in the United States This report is based on a study of 120 su h cases 35 of which were investigated within two years

2 The cardiovascular mamiestations depend on changes in the nervous system

in the vascular ystem and in the myocardium

3 Tachycardia followed by bradycardia gallop rhythm vagal reflex irritability dilatation of the heart dyspnoes orthopnoes and pulmonary congestion a somated with bounding arterial pulsation arterial pistol sounds engarged veins warm sain and orders are the usual clinical features of severe cases 4 The haemodynamics are characterized by low vital capacity of the lurgs high

ven our pressure and normal arterial pre sure and by a relatively or absolutely increased velocity of blood flow and decreased peripheral utilization of arterial oxygen. The osmotic pre use of the blood is usually moderately low and frequently remains

essentially unchanged while the ordema disappears

5 The electrocardiograms were normal in but 7 per cent of 57 cases The main abnormalities onnisted in changes in the T waves and prolongation of the ele trical systole (Q I) The electrocardiographic changes in patients with pellagra or beriben probably are due to the B 1 component of the vitamin deficiency

6 The my cardium often showed hydropic degeneration of the muscle and conductive fibers and increase in the intercellular substances but unaltered water

content 7 The cardiovas ular disturbances caused by nutritional deficiencies do not form a rigid chuical syndrome. Right ventricular failure left ventricular failure atteriolar dilatation and racreased blood flow peripheral circulatory collapse and shock singly or in combination have been observed

8 The onset of the disease may be sadd n or gradual Patients with the severe form of the disea e show a tendency to fever to bronchopneumonia and to acute fatal circulatory collap e Under therapeutic measures such as rest cardiac drugs diels nch in vitamin B i or crystalline vitamin B i all the terdiovascular disturbances usually revert to normal

g The chincal symptoms and sign the blood chemistry the myocardial changes the haemodynamics and therapeutic responses correspond to those described in beribers heart in the Greet The disease as observed in Boston however is characterized by more varied and more generalized tovolvement of the cardiovascular system

10 Evidence is presented indicating that vitamin B r deficiency plays a primary role in the precipitation of the disease. Alcohol also is a significant factor not only because it supplies calories without vitamin B r but also because its metabolic effect is similar to that of a pure carbohydrate.

21 The rate of response to vitamin B i in alcoholic and nonalcoholic betiben varies. The arteriolar system shows a more tapid change than the heart. The cardio vascular disorder usually disappears before the polyneunit. The factors influencing therapeutic responses are discussed.

12 In normal subjects as well as in patients with diseases other than vitamin B 1

deficiency even large doses of crystalline B produce no appreciable effects

13 The condition here described bears pertineatly on the chinical behavior and the mortality rates of alcoholic and nonalcoholic patients with vitamin B deficiencies (betibert and pellagar). It may explain the poor reaction of these patients to increases in metabolic rate such as occur in febrile infections in hyperthyroidi m or under sugical operations. The therepeate indications under these condition are discussed.

Atypical Benber.—Doubtless rudumentary forms of benberi in which the symptoms are difficult to recognize are extremely common. Patchesian of olderna which have been attributed to visionotor disturbances are seen occasionally in benber. Lesions of cranial nerves other than the vags and the phrenics occur rarely. Lesions of the phrenic nerves may cause naries of the disabilities.

Many cases of food deficiency are of mixed type — Symptoms attributable to scurry or to pellagra are frequently associated with those of benbern. Among the well known mixed forms of virtamin deficiency are ship benbern and Rand scurry. Although the relationship of nutritional ocidema to bethber its in doubt some of the cases of this disease in India have shown mild neuropathic symptoms or cardiac dilatation which could be ascribed to benbern. The chachable of British Somaliland as described by Buchanan (1932) has some features suggesting benbert but it seems to be more closely related to pellagra.

According to Jolliffe (1940) and R D Williams et al (1940) early thiamin deficiency may cause a variety of symptoms which are com

monly labeled neurasthema

Infant bertbern is bleely to appear in breast fed infants of mothers whose det is deficient in vitamm B: The mother may or may not show signs of beriber: The symptomatology in the infant differs considerably from that of beribern in the adult | Hoobler (1928) has well described the disease as seen in the Philippine Islands and also the milder types which be believes are common in the United States.

Vomiting constipation anorema loss of weight fretfulness and pallor are among the early symptoms. Vomiting is considered a gave symptom The cry becomes feelle and plaintive and the tone altered in a peculiar manner. The altered cry has been attributed by some writers to pressure on the left recurrent lary ngeal mere by a dalated auncle. Others have ascribed it to a lesson of the nerve itself. During acute attacks of colicky pain the body and limbs become rigid and there may be caponsis. Opis thotonos or convolusions may occur. There may be slight signs of menin geal irritation but the spinal fluid shows no abnormality. The muscles

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particularly those of the calves are apt to be hypersensitive and the knee jerks diminished, but there is usually little clear evidence of neuropathy

The course of the disease in infants tends to be rapid and the mortality used to be high Death is preceded by increasing tachy cardia oedema and congestive heart failure Lymphopenia is said to be common in infantile beribert

DIAGNOSIS

An early case of bernbert may appear to be well nourshed Bernbert should be considered as a possible diagnoss in cases of motor and sensory neuropathy in which the peripheral nerves are chiefly involved and also in cases of octema or cardiopathy which do not clearly belong in other categories. The diet in such cases should be seruitinized carefully Because there are no positive diagnostic entiena a diagnossi of bernbert requires exclusion of other diseases which can cause neuropathy, oedema or circulatory abnormalities. Among such diseases are tabes dorsalis pellagra nutritional ocdema, nephritis and various kinds of myocardial diseases. Thorthocres | phosphate poisoning ('ginger or 'jake' paralysis) causes a flaccid form of motor paralysis. The possible significance of this and of other neurotouc chemicals should be borne in rund when the diagnossis is in doubt

Evidence of a recent attack of diphtheria which has been madequately treated should suggest diphtheritic paralysis. Early paralysis of the soft palate extension of the neurological signs downward and fact of sensory disorders characterize most of the cases of diphtheritic paralysis. Arseni call paralysis may closely simulate benderi. Lead palsies as a rule are easy to recognize.

Even when a case of neuropathy has been ascribed to diphthera to one of the heavy metals, or to some other recognized neurotous agent it is still possible that deficiency of vitamin B i or defective utilization of this vitamin may play a significant etiological role. Some of the neuropathies occurring in diabetes may be traceable to vitamin deficiency athers occurring in diabetes may be traceable to vitamin deficiency. There are also indications that deficiency of vitamin B i is an important factor in Korsakoff syndrome in some cases of Landry s paralysis and probably also in Wennicke a syndrome. Vitamin B i deficiency may prove to be significant in some of the other diseases of the central nervous system which are not ascribable to inflammatory processes to arterio selections to therefutary influences or to the known neutrotoxic agents.

Among the conditions which may lead to be then as a sequel are dictary fadism unwise and prolonged therapeute restriction of diet chronic alcoholism, pregnancy and lactation hyperthyroidism malnutrition incidental to severe infectious disease, to chronic wasting disease, ciribosis of the liver, or to certain operations on the gastro intestinal tract. When neurologic lesions develop in connection with any of these conditions yitamin B I deficiency should be considered as a possible cause

The therapeutic test based upon administration of adequate dosage of thiamin over a period of ten days undouhtedly has diagnostic value in

cases of betibert having disorders of the circulation or of the digestion It can not be recommended for diagnosis of cases in which evidence of neurological lesions predominates



Fig 230-Cha actrice paton if tim toth benben (Aftr Werns)

Studie of the urmary excretion of thiamin (Robinson et al. 1940) indicate that under properly controlled conditions the level of the urmary



Fig. 231—Gart in t oph b best (From Ruge Mahlensand surverth)
excretion of thiamin permits an obective determination of the state of
thiamin nutrition in the human subject and that patients who have sub-

sisted on a diet which is deficient in thirmin excrete a smaller percentage of a test dose of thiamin than do persons whose diets have been adequate ın thiamin

It has been suggested that the determination of the amount of blood pyrusic and may be of value in diagnosis However actually this is of little value in the diagnosis of the di ease itself though it may be of some interest in measuring the severity of the infection and pyruvic acid is increased especially in severe fulminating or advanced cases Eddy and Dalldorf (1941) have employed the method of Platt and Lu for this purpose Values above 1 30 mgm per cent are considered abnormal

Prognosis -Death is to be expected in fulminating cases of beribers whether in adults or in infants. In the less acute cases deaths are frequent unless adequate treatment is applied promptly. The prognosis is better in cases in which neurologic symptoms predominate and in which circulatory disorders have not appeared. Perma nent disability may result from irreparable damage to the nerves if recovery is long delayed through failure to recognize the condition or to provide adequate treatment

PROPHYLAXIS

Diets which contain large proportions of starches or of starches and sugars should be supplemented by foods containing ample quantities of vitamin B r Under conditions which are known to require increased amounts of this vitamin the vitamin component of the dietary should be high

In countries or localities where polished rice is the principal food of large numbers of people ats use should be discouraged by appropriate legislation Undermilled rice barley and oatmeal are excellent sub stitutes During the winter months when poor families such as those of the fishermen of Newfound are likely to subsist chiefly on white flour and salt pork efforts should be made to provide them with the vitamin containing foods or with vitamin concentrates. The dietaries of ships on long voyages of prisons asylums garnsons and labor camps should he so planned as to provide the necessary accessory food factors

Bread made from whole wheat flour contains much vitamin Br whereas white bread contains little if any Where maize is the staple the meal used should contain the germ of the grain Excessive refinement as in the case of white wheat flour removes the vitamin-containing germ Some of the canned foods and especially those which are acid are said to

retain much of their original content of vitamin B r

Methods of cooking fresh meat and fresh vegetables require attention Prolonged boiling is likely through heat and oxidation to destroy vitamin Br Considerable amounts of it are dissolved in the water in which vegetables have been hoiled Ordinarily this water is thrown away It should be added to soup Cowgili (1939 a) believed that American dietaries as a whole are unsatisfactory with respect to the contint of vitamin B r and that it would be advantageous to add this substance to

staple American foods In the many diseases or conditions which predispose to beriberi the danger should be foreseen and preventive measures should be adopted More attention should be directed to the prevention of mild states of suboptimal nutrition or of partial deficiency Doubtless they are common in the United States and in Europe as well as in the tropics

The possibility that the thiamin content of soils and of fertilizers may he significant in relation to the food value of crops has been

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by Williams and Spies (1938) The relationship of soils to nutrition has been discussed by Auchter (1939) knowledge of this kind may prove to be of great value in the prevention of benberi

TREATMENT

General - When beriberi is considered as a possible diagnosis the patient should remain strictly in bed This precaution is vital in early or acute cases lest serious circulatory symptoms should supervene Cardiac stimulants are of little value for the circulatory disorders of beriberi Venesection may be beneficial in cases of acute congestion Distention is to be avoided Foods should be taken in small amounts and at more frequent intervals. When there is much oedema, the fluid intake should be limited Adequate treatment by diet and vitamin concentrates usually results in rapid elimination of the fluid by diuresis. The diet should be of high caloric value and should contain an abundance of all essential food elements including those of the vitamin B complex as a whole Cases which have neurological lesions of the limbs recover slowly. Meanwhile the development of contractures must be prevented. Opiates may be needed for severe neuritic pain

Vitamin B I -At first a considerable excess of vitamin B I as com pared with the normal requirement (p. 1054) should be administered in the diet or otherwise. It is important also to provide an abundance of the other vitamins and accessory food factors because more or less defi eiency of some of these substances is likely to coexist

Serious circulatory symptoms may develop rapidly even in mild cases of beriberi. Therefore it is safer to administer a vitamin concentrate from the outset rather than to trust to diet alone The concentrate used should be of standard quality and of known unit strength. The Inter national Unit is more often referred to in recent literature than is the Sherman Unit The International Unit has been considered as equal in terms of vitamin activity to from one to three or even four Sherman Units

Among the vitamin concentrates used to supplement the diet are extracts of rice polishings or of wheat brain and dry powdered brewers yeast which has not been autoclaved Autoclaved yeast contains vitamin B 2 but not vitamin B r The unit strength of the various commercial preparations of yeast differs markedly

Beneficial effects resulting from the administration of vitamin B r are to be expected only when the symptoms are due to a deficiency of this Appetite may return promptly digestive disorders may abate and circulatory symptoms may show rapid amelioration. Oedema and cardiac enlargement may disappear. The response of infants to vitamin concentrates may be dramatic

Neurological symptoms re pond but slowly particularly in cases of long duration McGee (1930) believed that the rate of cure of poly neuritis in alcoholics was determined by the duration of the symptoms rather than by the dosage of vitamin Br Dr Madelaine R Brown 1052 TREATMENT

(personal communication) expressed doubt as to the advantages of using thiamin or even vitamin concentrates in cases of peripheral neuropathy in alcoholics provided that the patient could take an adequate diet. All are agreed that improvement of 39 mptoms which are clearly due to degener attive lesions of the nerves in benben is very gradual under any known form of treatment. Inasmuch as repair of nervous structures is ordinarily a slow process it is doubtful whether rapid recovery can ever be achieved.

Dosage—Strauss (1938) has recommended for the mild type of case that 30 grains (2 Gm) of powdered brewers yeast of good potency be taken thruce daily. Definitely diagnosed cases of beribert were treated with pure crystalline vitamin B i (thiamin) by intramuscular or intravenous injection in the daily dose of 20 to 30 mg for a fortnight. There after oral administration in the same dosage was employed or if the injections of thiamin were continued the dose was reduced to 10 mg daily Aring and Spice (1939) recommended for an adult a diet providing 4500 calones and rich in vitamin B i. They supplemented the diet by administration of dred brewers veast (60 zo 1750 Gm daily), or extract of rice politahings (tiktitis) (3 oz oz 85 Gm daily), or expitaline vitamin B i (10 mg twice daily). They beheved that in severe cases of beriber 20 mg should be administered and that in cases of mild definency, dose of 5 mg daily are adequate. When there is reason to suspect that absorp tion of vitamin from the intestine may be impaired and probably also in diseases of the liver injections of thiamin are to be preferred to oral administration of thiamin or of concentrates.

According to Strauss (1938) overdosage with crystalline vitamin B 1, even when employed intramuscularly or intravenously entails no haim However Narat and Loef (1937) have reported the presence of depressor substancts in vitamin B 1 concentrates and even in a crystalline preparation of vitamin B 1. Their experiments were performed on dogs and rabbits. Caution may be advisable in the intravenous use of thamin in the presence of severe circulatory disorders of doubtful nature. Never theless intravenous injection is the method of choice for treating acute and alarming circulatory disorders which are caused by deficiency of vitamin B 1.

In morbund cases of benberi with circulatory failure. Hawes (1938) has observed astonishingly rapid improvement after (intravenous?) impection of huge doses of pure vitamin Br. He injected in some of his cases 2000 FU at a single dose. When too small a dose was given the benefit was transitory and was followed by collapse. The effect of a single adequate dose was lasting. Tone effects were not observed.

Because of widespread and increasing enthusiasm for the use of vitamin B 1 its well to remember that not all degenerative diseases of the nerrous system are due to deficiency of vitamin B 1. The combined degeneration of the cord which occurs in permicious anaemia and the lesions of the cord and brain seen in pellagra seem not to be appreciably benefited by admin istration of vitamin B 1.

VITAMIN B I CONTENT OF FOODS

Using the rat growth method of assay Booher and Hartzler (1930) have recently determined the vitamin B 1 content of many common foods. Their results were expressed both in international units and in millipramsof of thiamin for the odble portion of the food as prepared for cooking or for table isse. The foods tested were classified as follows.

Excellent (150 International Units or more per 100 Gm.)		
Beans lima dired Cowpeas dried Oatmeal quick cooking Oats rolled	Peanut germ Peanut skins Peanuts whole raw Pork chop (Ican portion)	Pork ham smoked (lear portion) Soybeans fresh green and dried
Good (100	to 150 International Units p	er 100 Gm.)
Beans lima green Beans navy dried Co n meal white Egg yolk	Milk powder skim Milk powder whole Peas green	Rye whole Walnuts Persian (English) Wheat whole
Fair (30	to 100 International Unita per	o Gm)
Asparagus Beef lean muscle Broccoli Brussels aprouta Ca liflower Chicken dark meat Corn meal yellow	Corn sweet Kale Lamb lean muscle Liver Mustard greens Okra Peanuta ronsted than so International Units p	Pineapple Potatoes Prunea dried Spinach Sweet potatoes Turang greens Wheat shredded
		1
Apples Bananas Beans g en suap Beans yellow wax Beets Blackbernes Cabbage Carrots Celery Cheese Chicken white meat Cocoa Corn fiskes Egg white	Fish hal but Fish hal but Fish salmon red canned Fish trout firsh water Floor wheat straight milied Flour patent Grapefrunt Lettuce head Milk condensed Milk condensed Milk skim Milk whole Molasses Mutkmelon Mutkmelon	Onions Oranges Peaches Pears Flums Raspberries black Raspbe ries red Rhubarb Rutabag s Sauerkmut Jusah Strawbe ries Tomatoes red Tumps

The vitamin B i content of ordinary diet can be enriched by adding to soup either barley or the water in which vegetables have been boiled by eating vitamin rich cereals such as oatmeal or barley by using whole

ro54 treatment

wheat bread and by replacing some of the ordinary meats with liver kidneys or other glandular organs. Most of the vitamin B r content of eggs is in the yolk. The legumes are relatively rich in vitamin B is relatively mean or witamin B r in fants fed on cow s milk should therefore take a concentrate of vitamin B r.

As to canned foods it has even been stated* that "commercially canned foods may be depended upon to supply vitamin B i to extents proportional to the amounts of the vitamin originally present in the raw materials from which they were prepared

The Council on Foods of the American Medical Association (Rose 1940) has reported on the effects of refrigeration and cooking (p 1359) as follows

Losses in vitamin B r (hinmin) content of quick frozen foods are due to the preliminary blanching or to cooking for the table rather than to the refingeration. Thus Rose and Phipard found no loss of vitamin B r in frozen peas as compared with the same peas fresh and uncooked but there was a loss of 26 per cent brought about by cooking fifteen minutes no cooking water being discarded. An even greater loss in sbot time cooking has been reported by Munsell and Kifer, namely a depreciation of 50 per cent in cooking broccoli for fifteen minutes. Fellers that the same personal process of the same Br in frozen peas and little in spinach (8 per cent) but in the case of lima beam and asparagus the differences between fresh and frozen averaged 52 and 26 per cent respectively. The order of loss appears to vary with the blanching time indicating again that cooking rather than freezing is responsible for the change

Vitamin B-I Requirements—The Technical Commission of the League of Nations Health Commission recently estimated the human requirement for vitamin B is. The Report (1938) said that. An allowance of ro international units per roo calories of food intake seems to be adequate. This allowance would place at 300 international units the duly requirement for an adult of 70 kilogrammes body weight receiving a diet of 3000 calories. It was further recommended that the deets of pregnant and lactating women should contain two to three times the amount of the minimal daily requirement (i.e. 600 to 900 units) that infants should receive ro to 15 international units per 100 calories of food intake and that 200 to 250 international units be allowed for nursery school children. These recommendations closely approximate those of Cowgill (1938).

Pharmacology of Thiamin —The heat labile part of the vitamin B complex which is known to be important for man is vitamin B r In

its chemically pure crystalline form it is called thiamin or aneurin

Thiamin is usually prepared and administered as the hydrochlonde (also called chloride or crystalline vitamin B 1 hydrochlorid). In solution thiamin is acid. It can be sterilized at 120 C because heat has httle effect upon it except in neutral or alkaline solution (Williams 1939)

Thiamin crystals absorb water on exposure to air and they are very soluble in water

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wheat bread, and by replacing some of the ordinary meats with liver kidneys or other glandular organs. Most of the vitamin B r content of eggs is in the yolk. The legumes are relatively rich in vitamin B I even when dried Although rich in other vitamins, fresh cow s milk is relatively poor in vitamin B i Infants fed on cow s milk should, therefore, take a concentrate of vitamin B x

As to canned foods at has even been stated* that commercially canned foods may be depended upon to supply vitamin B I to extents proportional to the amounts of the vitamin originally present in the raw materials from which they were prepared

The Council on Foods of the American Medical Association (Rose 1940) has reported on the effects of refrigeration and cooking (p. 1359)

Losses in vitamin B 1 (thiamin) content of quick frozen foods are due to the preliminary blanching or to cooking for the table rather than to the refrigeration Thus Rose and Phipard found no loss of vitamin B r in frozen peas as compared with the same peas fresh and uncooked but there was a loss of 26 per cent brought about by cooking fifteen minutes no cooking water being discarded An even greater loss in short time cooking has been reported by Munsell and Kifer namely a depre ciation of 50 per cent in cooking broccoli for fifteen minutes Fellers Esselen and Fitzgerald have reported practically no loss of vitamin B 1 in frozen peas and little in spinach (8 per cent) but in the case of lima beans and asparagus the differences between fresh and frozen averaged 54 and 26 per cent respectively. The order of loss appears to vary with the blanching time indicating again that cooking rather than freezing is responsible for the change

Vitamin B-x Requirements -The Technical Commission of the League of Nations Health Commission recently estimated the human requirement for vitamin B r The Report (1938) said that An allowance of ro inter national units per roo calories of food intake seems to be adequate This allowance would place at 300 international units the daily requirement for an adult of 70 kilogrammes body weight receiving a diet of 3000 calones It was further recommended that the diets of pregnant and lactating women should contain two to three times the amount of the minimal daily requirement (i.e. 600 to 000 units), that infants should receive 10 to 15 international units per 100 calories of food intake and that 200 to 250 international units be allowed for nursery school children mendations closely approximate those of Cougill (ro38)

Pharmacology of Thiamin — The heat labile part of the vitamin B complex which is known to be important for man is vitamin B r In its chemically pure crystalline form it is called thiamin or ancurin

Thiamin is usually prepared and administered as the hydrochloride (also called chloride or crystalline vitamin B 1 hydrochloride) In solu tion thiamin is acid. It can be sterilized at 120 C because heat has little effect upon it except in neutral or alkaline solution (Williams 1039)

in young children The local incidence of pellagra depends largely on the economic status and consequent dietary habits of the population. In those parts of Europe and of the United States where the general economic level is low and where maize is the staple food of the poor large numbers of cases of pellagra have occurred. There have also been outbreaks in asylums and in camps when the detary was inadequate in vitamins.

Contributory or secondary factors including infectious diseases may influence the incidence of pellagra at a particular time or place. In the United States new cases of pellagra may develop at any season but they appear most frequently during the early spring

ETTOLOG

When one compares the evolution of knowledge about their ctuology a straining parallelism is revealed between the history of betriber and that of pellagra. Both have been attributed in turn to specific articles of diet to torum of doubtful nature and to a variety of infectious organisms. Both diseases are now ascribed to deficiency of vitamina. The primary and essential cause of pellagra seems to be deficiency of components of the heat stable portion of the vitamin B complex. Deficiency may be brought about by inadequate ingestion or decreased absorption or probably by disorders of metabolism which might interfere with utilization of vitamins after absorption. Among the contributory causes of pellagra are the acute or chronic infectious diseases particularly those associated with diarrhoes the chronic wasting diseases chronic alcoholism pregnancy and lactation.

Sydenstrucker et al (1036) offered the hypothesis that along with deficiency of an extrainse factor there is more or less deficiency of an intrinsic factor as well. They believed that some individuals retain enough of the intrinsic factor to recover even on an inadequate diet that others regenerate it rapidly when treated with an abundance of the extrainsic or dietary factor and that still others totally lacking in the intrinsic factor are unable to regenerate it even under optimizing their therapy. Even in the absence of the intrinsic factor patients may recover under substitution therapy. A possible relationship between pellagra and disturbed hier function of failure of a diseased liver to store the required vitamins has also been postulated by Sydenstrucker et al (1930).

Milk meats and dired brewers yeast contain the heat stable portion of the vitamin B complex which was formerly called vitamin B z or vitamin B. The study showed that vitamin B z contains various different substances which are important for the nutrition of man or of animals (p 1036). At this point confusion as to nomenclature arose. The literature indicates that such terms as vitamin B and vitamin G have meant different things to different authors. These terms interfore should be dropped. The term Vitamin B z complex will be used here to designate the group of heat stable components of the Vitamin B complex.

The vitamin B 2 complex includes incotinic acid and riboflavin which have proved to be important for nutrition in man. It contains also

Chapter XXXIV

PELLAGRA

Synonyms -- Psilosis pigmentosa, Mal de la rosa, Mal del sole Alpine scurvy Chichism (northern South America)

Definition —Pellagra is now beheved to be a nutritional disease in which there may be deficiency of more than one component of the heat stable portion of the vitamin B complex—Still other deficiences coexist in many cases—There is no chinical ground for distinguishing 'endemic from sporadic cases of pellagra

Typical and advanced cases of pellagra are characterized by three groups of symptoms a peculiar form of dermatitis digestive discretes with

or without diarrhoea and psychoses of the confusional type

History — Credit for the first description of this disease is usually given to Casal who saw it in Spain in 1732. His paper was not published until 1762. Frapolli named the divease pellagra in 1777. After 1810 and for a hundred years the behef was widely held that pellagra wax-caused by eating male. Those who supported the maire thory were called easts. Zea mays is the scientific name for maire or Indian corn. The well known re earches of Goldberger paved the way for the concepts of pellagra which are current today. Infection is generally regarded now as a contibutory factor in some cases but not as a primary cause of pellagra As late as 1940, some still believed pellagra to be an infectious disease.

Geographical Distribution —Pellagra has been common in Itali, Spain Portugal, the Balkan States Greece and Turkly There were about 100,000 cases in Roumania in 1906 The incidence of the disease in Italy has been decreasing for a long time. In 1910 there were only

33 800 cases reported there, as against 104 607 cases in 1981

In Fgypt pellagra was first recognized by Sandwith in 1893. It has been widespread in Lower Egypt but rare in Upper Egypt where the people cat millet instead of mauze. It occurs also in Algeria and in other parts of Africa. Probably pellagra is common in India, the Straits Settle ments. China. Japan, and the West Indian Islands. It is common locally in Mexico and in parts of South America.

After the recognition of pellagra in the United States by Babcock in toor, the direase was found to be very prevalent in the southeastern states. During the past to years cases have been discovered in many other parts of this country. Doubtless related cases could be found in almost any part of the world.

Incidence —Pellagra may appear in persons of any race at any age and in either sex. In ome localities it is more common in males than in females or vice versa. Pellagra is said to be rare in infants but common

ascribed to the existence of photodynamic substances circulating in the blood Porphyrin (p. 1060) was incriminated by Bassi (1014) but Ander son and Ayres Jr (1934) heheved that the hypersensitivity is related to disturbed sulphur metabolism and through this to amino acids and per haps also to the vitamins Similarly the skin of pellagrins is said to be abnormally susceptible to mury by x rays The lesions seen occasionally on the genitaba appear to be unitative phenomena caused perhaps by



Fig 233 - Butt fly erupt m on f ce of h ld tw

substances excreted through the skin. The dermatitis seen in some cases on the elbows and knees might be attributed to the effects of friction against the bed clothes acting upon an abnormally sensitive skin

PATHOLOGIC PHYSIOLOGY

Turner (1931) reported the following findings (a) Plasma volume 32 per cent above and 68 per cent below normal (b) Red cell volumes 5 per cent above and 95 per cent below normal (c) Total blood volumes 17 per cent above and 82 per cent below normal

vitamin B 6 and pantothenic acid. It is generally recognized now that deherency of incounic acid (p. 1036) is an important cause of some of the symptoms of pellagra. The situation with regard to riboflavin is less clear. The eigniteance for man of vitamin B 6 is uncertain (p. 1037), and that of nantothenic acid is still obscure.

Pellagra appears now to be a syndrome caused by deficiency of more than one fraction of the vitamin B 2 complex. The varied symptoma tology and the occurrence of atypical cases can be attributed to differing



Fig 232 - Dry dermaists on face hand neck and upper ch Egyptian ca

degrees of deficiency of the several important components of the vitamin B 2 complex and to the lack in some instances of other substances essential to nutrition. Among these other factors which completate the picture rather frequently are deficiency of vitamin B 1 of iron, or of motion

Nutritional disorders apparently alhed to pellagra but showing diver gent symptomatology have been reported from Africa by Stannus (1936) and by subsequent authors (Trop Dis Bull 1936 vol 33 nos 11 and 12 up 815 and 885)

Exposure to direct sunlight tends to aggravate or to produce skin lessons on exposed surfaces. The increased sensitivity of the skin to sun light is mainfe ted during the active stages of pellagra. It has been

changes in the skin the mouth and the oesophagus were described in detail by Denton (1925)

Gastro-intestinal Tract —The most frequently observed of the gastro intestinal lesions in pellagra is glossits with or without stormattis Superficial ulearation follows in some eases and secondary infection may occur Similar lesions may be found in the oesophagus in the stormach and in the small or more often in the large intestine. The wall of the intestine may be abnormally than The liver and the spleen usually show atrophy. The liver frequently exhibits fathy degeneration. The viscera may be pigmented. The heart may show fatty degeneration or brown

atrophy and fibrous. The adrenal glands are frequently diseased.

Nervous System —Lessons of the netrous system bave been demon

strated in the brain the cerebellium the medulla and pons the cord and
the penpheral nerves. The distribution of the lessons is extremely vari
able. Damage to nerve structures is seldom visible except under the
microscope. Lynch believed that still other neurological lesions may

east which are not demonstrable by a valiable technical but which can

give rise to symptoms

Among the gross changes which have been found in the nervous system in pellagra are ordema or wasting of the brain excess of fluid in the ventricles and extensive degeneration in various parts of the cord. The distribution of the cord lesions is so variable both as to the structures cherly invoked and as to the kwel of the more pronounced pathology that general statements are of little value. Probably the principal lesions of the cord occur most frequently in the cervical and lumbar regions and in the crossed pyramidal tract in the posterior tract of Goll and in the fibers of the posterior trois. The anterolateral tract seems to be in volved less often. The tract of Burdach and the direct cerebellar tract usually escape.

Frequently the nerve cells of the anterior and of the posterior horns in the spinal gord show degenerative changes. The corresponding cells in the medulla and pons the pyramidal cells of the cerebral cortex and the cells of Putsinje in the exceledium may, how similar changes. Lang worthy (1931) found pigment deposits in the cells of the sensory and autonomic gancia and those in the spinal cord and brain stem.

autonomic ganglia and those in the spinal cord and brain stem.

The small cells of the sensory ganglia showed the greatest deposit of pigment.

Similar lesions of the brain and of the sympathetic ganglia have been reported by others.

Symptoms

Course —The usual course of pellagra is subjecte or chronic but acute cases occur and relapses are common The duration of the disease varies from weeks or months to many years

The first symptoms noted by the patient are apt to be skin lesions resembling sunburn or digestive disorders or both. Less often mental disorders are among the early signs of pellagra. As a rule, their appear

1060 PATHOLOGY

Indicanuria has long been recognized as a frequent occurrence. It has been attributed to increase of the putrefactive process in the intestine

James H Smith (1931) has advanced some important concepts regarding the skin lesions of pellagra. He said "An adequate supply and a normal metabolism of sulphir appear to exert a protective militare against the pathologic effects of solar arradiation. The evidence suggests that an inadequate supply of sulphir as cystine is an important cause of pellagra and that the abnormal metabolism of sulphir is an important feature of pellagra.

Although albumen and casts are present in the urine in about 50 per cent of cases of pellagra, renal disorders are not characteristic of the disease

(Sullivan Stanton and Dawson 1921)

Several recent writers have reported excess of porphyrin or of por phyrin like pigment 'in the unite of pellaginis. Meiklejohn and karl (1939) discussing the test for porphyrins as used by Beckh Ellinger and Spies (BES Test) offered a different interpretation of its meaning They soul at would seem more proper to refer to the BES test as indicating the presence of pigments capable of producing the uncrossen reaction rather than to refer to such pigments as porphyrin like substances which they in no manuter resemble.

Campbell and Shaver (1937) reported that the blood of pellagran reduces todine solutions at a constantly greater rate than does the blood of normal or of diseased control patients They believed that this reaction might be of value for disgnosss

Hypersensitiveness to insulin has been reported as occurring in pel lagrins Mainzer (1939) has attributed it to disease of the adrenals with

consequent disturbance of carbohydrate metabolism

PATHOLOGY

The pathology of pellagra is neither constant nor character to Lynch (1932) and that the structural changes of pellagra are primarily degenerative but may become structure or even inflammatory in character. These changes may be widespread in the surface epithelium of the skin and in the mucoss of the abmeniary tract or in the nervous system Emaciation which is usually pronounced and which may become extreme is very constant. Alrophic changes may be found in all the tissues, and in any organ.

Skm —A dermatite associated with patchy or diffuse pigmentation usually occurs on surfaces exposed to light. It is most common on the barks of the hands and on the cheeks. It may he seen on the back of the neck or over the upper part of the steraum. Fry thema precedes pigmentation Similar skin lessons are seen onthe dorsal surfaces of the feet on the shins and on the toreatms of those who e clothing does not cover these parts. Dermatitis with thickening of the epidemia and ery thema sometimes appears on the cibows and on the lines especially in bed ridden patients. Erythema or increased pigmentation and dermatitis, may be found also on and about the genitalia or the sinus. The histological

The group of digestive symptoms includes sensitiveness of the tongue and buccal mucosa, burning pain over the oesophagus and in the epi gastinum loss of appetite eructations flatulence colic vague abdominal distress and diarrhoea or constipation. Attacks of diarrboea may alter nate with constipation. Dendation of the epithelium of the tongue is apt to be especially marked at the tip and along the edges but the whole tongue may be bright red rough and fissured. The buccal mucous membrane may share in the process and superficial ulceration may develop. The prosiss and epigastric pain which succeed the taking of food may be so severe that the patient fears to eat

Nerous System—The neurological picture in early cases is ill defined and the symptoms may be transitory. Headache vertigo cramps in the muscles backache shooting pains in the limbs and sleeplessness and neurasthemic symptoms are common. Coarse tremor of the hands of burning pains in the palms of the hands or burning pains in the palms of the hands or soles of the feet and pareathesis or formation are frequently experienced. In advanced cases the picture is usually that of spastic paraplegia with atain and increase of the deep reflexes. Romberg a sign. Chvostel, a sign tremor of the hands or ankle clonus may appear and finally contractures may develop. Epilepitform attacks of cortical type or somnolence have been observed. In cases in which the knee jerks are diminished or absent deficiency of vitamin B r may be a factor.

The early mental symptoms of pellagra resemble those of neuranthema More definite psychoses appear later. They may simulate manic depre are insantly general parests or semis dementia. Hypochondrians or melanchoita may lead to suicide. Hallucinations or mannacal attacks may occur. In cases of long duration the insantly may become incurable increasing weakness and muscular incoordination ultimately render the patient hebless. Having reached a condition of extreme meanation he

dies of exhaustion or of intercurrent disease

Lesions of the cranial nerves occur occasionally in pellagra Among them retrobulbar neuritis seems to be relatively frequent. It appears early Lesions of the factal nerves or of the ocular muscles optic neuriti touc amblyopia or nystagmus may be caused by deficiencies of components of the vitamin B complex. They may bowever be more depend upon deficiency of B i than upon lack of constituents of the B 2 complex.

Circulatory disorders are seldom prominent in pellagra but in a study by Mainzer and Krause (1946) of 32 cases in Egypt slight electrocardio graphic changes were found in about three fifths of the cases. In some of the cases the changes disappeared rapidly after administration of montime and The electrocardiae changes were not considered characteristic of pellagra and some at least of them have been observed in heriber. Tachycardia was most commonly encountered at the height of the disease and bradycardia during convalescence

Infantile pellagra appears to be relatively common in China and in Africa Cases tend to be atypical or mild A great variety of local names have been applied to it Signs suggesting pellagra are often com

ance follows that of other signs. Increasing weakness loss of weight, and redness and decudation of the tongue are usually associated with the other signs of the disease

Ordinarily, the temperature in pellagra is subnormal, normal or but slightly elevated In fulumant cases the temperature may be high Anaemn when present is usually of moderate severity. The cell volume is generally decreased but it may be increased. Leukopaema with rela tive increase of lymphocytes is to be expected. Hydrochloric and may be diminished or absent from the pastne secretion even after administra tion of histamine. The digistive ferments and the quantity of gastric juice are said to be decreased. Abnormalities in the spinal fluid are not seen in typical cases. Individual cases rarely exhibit all the common symptoms of pellagra

Skin -The distribution and general character of the skin lesions have been described under Pathology (p 1060) The lesions are strikingly symmetrical Ordinarily, those on the hands are sharply delimited at the wrist and do not extend to the two distai phalanges. The dermatitis on the face is les circumscribed than that on the hands. It involves espe cially the malar prominences chiefly, and the bridge and the sides of the no e The forehead and the anterior aspect of the chin may be affected The skin les ons follow a sequence of development beginning with ery thema with or without light oedema. This stage is succeeded by thickening and roughening of the epidermis and by a dirty looking pig mentation. In the more acute cases vesicles may appear. Usually patchy exioliation of the skin leaves depigmented areas in which the new skin appears to be attorhied. Sometimes there is a pigmented area which extends from the sternum around the back of the neck and onto it e mastoid processes. The lower margin of pigmentation may be sharply defined whereas the upper border merges gradually into the normal skin of the scalp. In some cases a line of pigmentation encircles the neck

The lesions which occur on the elbows and knees show redness thick ening and exfoliation with little or no pigmentation. They have some resemblance to psoriasis. On the scrotum, the vulva and in the region of the crotch, there may be patches of dermatitis with redness or increased pigmentation There may also be balanitis, vaginitis, or urethritis milder skin lesions cause little discomfort and they may not be noticed by the patient More severe lesions are associated with sensations of hurning and itching Pigmentation persists for a long time after recovery from the dermatities The nails may be atrophic and brittle or deformed

The skin lesions in the Negro show increased black or purplish pig Those in o'ive skinned persors are dark reddish brown

Not infrequently one sees on the sides of the nose a yellowish granu lar dry substance which protrudes like little horns from the mouths of the sebaceous glands Similar lesions may sometimes be seen on the chin

Angular stomatitis' and cheditis (chedosi) are not uncommon in pellagra Recently several authors have attributed these lesions and also certain lesions of the eyes to riboffavin deficiency (p 1036)

with resulting nutritional ordema is present in 15 per cent of the pellagrins seen in his clinic in Georgia and that anaemia due to iron deficiency is found in 35 per cent

The syndromes of Korsakoff and of Wernicke may be associated with characteristic signs of pellagra. These syndromes are now attributed to deficiency of substances contained in the vitamin B complex. It is possible that several other degenerative diseases of the nervous system are to be similarly explained (p 10.36).

Pellagra typhus is an acute form of the disease associated with high fever delirium tremors generalized rigidity and convulsions. In cases of this type the patient may appear well nourished. This condition is

believed to be rare

Subchineal pellagra has been described by Aring Evans and Spics (1939) as follows: Subchineal pellagrans are noted for the multiplicity of their complaints among which are many that are usually classified as nearstheme. The most common of these symptoms are fatigue insom nia anorezia vertigo burning sensations in various parts of the body numbness palpitation nervousness a feeling of unrest and anxiety headache forgetfulness apprehension and distractibility. The conduct of the pellagran may be normal but he feels incapable of mental or physical effort even though he may be ambulatory.

Mindus (1939) in a series of cases of gastric disfunction of uncer tain nature found achilar or hypochylia in about 91 per cent. The clinical picture in his cases was characterized by anorexia loss of weight simple anaemia insomnia amenorrhea bypesthesia lassitude muscular weakness and anutery depression or apathy. Many of these patients

responded well to treatment for pellagra

DIFFERENTIAL DIAGNOSIS

There is no satisfactory test by which a diagnosis of pellagra can be confirmed. Diagnosis is easy in cases showing the more characteristic lesions of the tongue and of the skin. Nevertheless many cases of pel lagra have been erroneously ascribed in the past to sunburn to my posoning or to armous skin intrinatis used commercially.

Characteristic seasonal incidence a history of a previous attack or the recognition of other cases in the vicinity or in the population group to which the patient belongs may help to establish an otherwise doubtful obtained by the patient belongs may help to establish an otherwise doubtful history indicating a hackground of dietary deficiency or of chronic also holism. Frompt response of the gastro intestinal or mental symptoms to treatment with moottine card or rapid improvement of certain other lesions after administration of riboflavin is highly suggestive of pellagra Responses to dietary treatment alone are less rapid. The vague symptomatology of subchinical pellagra should be borne in mind lest the patient be dismissed with a diagnoss of neutrasthema.

It should be remembered that pellagra may be combined with signs of deficiency of various other essential food factors that it can develop as bined with evidences of deficiency of vitamin A B i C or D or with lack of protein or iron Oedema is a feature of some of these cases Des quamative dermatitis may be extensively distributed on the body course of infantile pellagra may be relatively acute



Fig. 234 -- Wet dermat tis Local rat on usual Hand oedematous Cachect c state South Carolma case (From Law ader and Bab ock)

Atypical Pellagra —Occasionally soreness of the tongue only or mild gastro intestinal discomfort or increasing weakness and loss of weight occur without characteristic skin lesions. These cases have been called pel lagra sine pellagra. Other cases may show features resembling sprue or perincipous anaema. So dematricker (1946 b) Saul that protein deficiency

PELLAGRA 1067

Those in authority should guard against pellagra in labor camps garrison, prisons and asylums by assuing themselves that detaines are adequate in pellagra preventing foods. In the treatment of chronic diseases which interfere seriously with nutrition the dietary should include milk eggs and fresh meat. When these cannot be taken in adequate amounts the administration of brewers yeast or microtime acid and ribofiavin is indicated for prophylaxis.

TREATMENT

General —Ambulatory eases of pellagra can be treated by rest and improved diet but it is well also to administer meeting acid

When not exposed to direct sunlight the skin lesions on uncovered surfaces show a striking tendency to disappear even when the diet con tinues to be madequate It is difficult therefore to determine the effect on the skin lesions of dietary or of other forms of treatment. The effects of treatment for pellagra must therefore be evaluated largely on the basis of the response of symptoms relating to the gastro intestinal tract or to the nervous system. After adequate treatment improvement in the con dition of the tongue and of the buccal mucosa and amelioration of the digestive disorders appear with considerable promptness. Symptoms referable to the nervous system respond more slowly as a rule. An adequate diet for those who can assimilate it cures all the symptoms of pellagra In severe eases of pellagra or those of long standing the digestive system may be unable to cope with an adequate diet even when administered in the form of hourds and soft solids. Sometimes the administration of brewers yeast causes diarrhoea or vomiting. Under these conditions micotimic acid (p. 1068) or liver extract should be used The lesions which have been ascribed to riboflavin deficiency (p. 1036) may yield slowly or not at all to meeting acid but they may respond quickly to riboflavin Vitamin B 6 pantothenic acid and perhaps still other heat stabile components of the vitamin B complex (p. 1037) may yet prove to be important in the treatment of some of the symptoms of pellagra It is important to administer to the patient all the necessary food factors by diet or otherwise. As in beriberi so also in pellagra conditions which increase the basal metabolic rate require larger amounts of the vitamins

Nicotinic acid is ineffective as a remedy for nutritional cardiopathy or peripheral neuropathy

These conditions usually respond to thiamin (p. 1054)

The crude liver extracts used by mouth may relieve most of the symptoms of pellagra but the more refined preparations intended for injection seem not to contain all the substances required. According to Ruffin and Smith (1934) they may be beneficial for macrocytic anaemia when present in pellagra Ruffin and Smith (1937) have also expressed the view that liver contains two factors both of which are necessary for the treat ment of pellara.

1066 DIAGNOSIS

a concomitant or sequel of a great variety of diseases in which the ingestion or assimilation of nourishment is seriously disturbed, and that mental disorders may be the first symptoms observed

The nervous and mental symptoms of pellagra must be differentiated from those of vitamin B r deficiency, permicious anaemia general paraly sis neuro syphilis cerebral arterioselerosus and semility. Usually the neurologic lesions of permicious anaemia re emble those of beriben rather than of pellagra. The central ocuritis described by Adolph Meyer, and Scott spalsy (a form of central neuritis seen in Jamaica. Sterra Leone and Nigeria) have striking resemblances to pellagra. They may be ctio logically related.

It seems probable that certain cases of chronic ulcerative colitis are dependent, at least in part, upon deficiency of components of the B complex. The same may be true in some instances of poisoning by the heavy

metals

According to Barondes (1936) selenium poisoning in animals or alkali disease, resembles pellafara in that gastro intestinal symptoms nervous and mental disorders and demastits following exposure to bright sunlight are common to both. There appears to be a relationship between the toxicity of selenium and dietary defects. Thus it seems possible that cases of selenium poisoning in man might be mistaken for pellagra.

Prognosis—The mortality from pellagra has been high and some times very high in the past. Since the advent of modern methods of treatment the prognosis has improved enormously. In general recovery is to be expected not only in early cases but also in chronic cases with advanced emaciation and severe digestive disorders provided that adequate treatment is applied promptly. The outcome is uncertain even with good treatment, in the presence of serious infereuriert diseases.

PROPHYLAXIS

Because the incidence of pellagra is intimately related to poverty and to the monotonous and unadequate detaites which poverty, may impose the large scale prevention of pellagra is partly an economic problem and partly one of education in the essentials of mutrion. Goldberger showed years ago that pellagra can be prevented by adding to an ill balanced diet sufficient quantities of fresh meat milk and eggs and that dired brewers yeast also contained his pellagra preventing or P?

As Sebrell has pointed out (1938) the prevention of endemic pellagra is simple in theory but difficult to practice. To this end one should not forbid the ordinary and chaep foods of the locality but should advise that they be supplemented by green leafy vegetables fresh or canned milk or buttermils, lean pork instead of fat pork canned salmon haddoc. and corned bed poultry and rabbits (see also p. 1053). Home gardening should be encouraged in order to provide fresh vegetables. Powdered veast or incotinic acid may be distributed in the spring months when pellagra develops most often. Measures which reduce the incidence of chronic alcoholism are fikely, also to reduce that of pellagra

Nicotinic acid has been administered by mouth in solution in tablets or in capsules In small numbers of cases it has been used by hypodermo clysis intramuscularly or intravenously dissolved in sterile physiological salt solution Administration by mouth is usually the method of choice

Aring et al (1939) recommended that at least 500 mg should be admin istered daily by mouth in 10 equal doses In extremely severe cases they suggested dosage of 1000 mg daily They have used as much as 2000 mg daily m divided doses without untoward results. In a comprehensive article on the treatment of pellagra Spies Bean and Stone (1938) reported excellent results in pellagra following the use of micotinic acid micotinic acid amide or sodium nicotinate by mouth. They state that 500 mg daily in divided doses is usually effective but that double dosage seemed sometimes more beneficial and that small dosage may give dramatic results

Single doses of 200 mg by mouth or 10 mg intravenously very promptly produced flushing of the face and of the upper part of the trunk This was associated with burning and itching sensations increased activity of the sebaceous glands and sometimes with increased gastro intestinal motility Nausea vomiting or abdominal cramps sometimes followed the taking of large doses. Nicotinic acid tends to increase the secretion of hydrochloric acid in the stomach

Various authors have advised caution in the use of the larger doses of theotime acid until more is known about this drug Prolonged use might have ill effects thus far unknown and reactions attributable to idiocyn cracies may later be reported The dosage for children should be roughly in proportion to body weight Field Jr and Robinson (1940) have given as much as 500 mgm of nicotinic acid amide by mouth on an empty stom ach without causing vasodilatation or any abdominal cerebral or cardiac symptoms Nicotinic acid amide is a normal constituent of the body whereas nicotinic acid is not Therefore use of the amide would seem to be preferable

Spies Bean and Stone (1038) used meating acid intravenously in only two cases of the series then reported One patient showed marked improvement after receiving 10 mg daily for 4 days and another after

taking 20 mg daily for the same period

In another article Spies Cooper and Blankenhorn (1938 a) reported having used 30 mg of mooting acid in physiologic salt solution as a single dose administered intravenously at the rate of 2 mg per minute and as much as 80 mg to a patient within several hours. To another patient roo mg was administered in a liter of physiologic salt solution by infusion Untoward symptoms did not occur Probably nicotinic acid should be used by the intravenous route only when the patient because of vomiting cannot take it by mouth

In a number of cases of pellagra which were kept on a restricted diet and treated with nicotinic acid only relapses have occurred. They have yielded to increased dosage Other such cases have developed peripheral neuropathy while taking mostime acid. These observations serve to 1068 TREATMENT

Hypochromic anaemia requires iron. When absent from the gastric secretion, hydrochloric acid can be pre-cribed advantageously by mouth Good results have followed the use of ventriculin in cases in which the pastric secretion was defective

All severe cases of pellagra require rest in bed and excellent nursing Special efforts are needed to ensure cleanliness and to prevent the development of bed sores and of contractures Bland outments and protective dressings are useful when the skin lesions are severe. The skin should not be exposed to direct sunlight until convalescence has become well established

Diet -The diet of the pellagrin should be of high caloric value (3000 to 4000 calones) and nich in all of the accessory food factors. In particular, the constituents of the vitamin B complex as a whole should be supplied in abundance To treat a case of pellagra with a single active constituent of the vitamin B complex is to invite the development of manifest deficiency of other components of the complex

Fresh milk, buttermilk eggs lean meats liver and kidney are among the common foods which are particularly beneficial to pellagrins. To these foods should be added broths fruit junces and fresh green vegetables When the digestion is much disturbed the patient may be able to take only hounds and soft solids. Feedings should then be admin stered at frequent intervals Routine diets are to be avoided in severe cases of

pellagra

Feast -- Brewers yeast has been used extensively in the treatment of pellagra as a source of stamuns Prompt and pronounced benent following its use has been reported by numerous observers. It appears how ever that the various preparations available differ much in potency, and that no very satisfactory method of standardizing them has vet been devised (Rhoads 1939)

Brewers yeast is ordinarily pescribed in the form of a dry powder. The use of autoclaved yeast which is lacking in vitamin B z probably should be limited to experimental purposes Formerly the usual dose of powdered yeast was 15 to 30 Gm daily or about 3 to 6 level teaspoonfuls in divided doses Doses of 75 to 100 Gm daily are now being recom mended. No deleterious effects aside from diarrhoea in some cases have been reported from such dosage of pure, dried yeast Moist yeast cakes are not ordinarily used and compressed tablets are out of the question because adequate do age can scarcely be given in this form Powdered yeast can be stirred up with milk eggnog tomato juice or warm water and salt or it can be eaten with cereals The daily dose should be divided into portions to be administered at intervals of a few bours

Vicotinic acid is a pure crystalline substance which can be made synthetically It is present in considerable amounts in the foods which have proved beneficial for the prevention and treatment of pellagra and is a constituent of the beat stabile portion of the vitamin B complex Neither the maximal nor the minimal dosage of meotime acid has yet been determined The optimum dosage varies greatly in individual cases

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contrast to the fiery red color of the tongue of the pellagran they said that the tongue of inbofas in deficiency has a purplish red or magenta hue. It is clean and the papillae are flattened. The ocular signs and symptoms include vascularization of the corner keratuits resembling that seen in syphilis itching or burning sensations of the lds more or less photophobia and dimness of vision or partial blindness in poor light. These authors claimed that the lessons did not yield to vitamus A or C thaimm or nice time and but that they were cured with riboflavin. In some cases they recurred after thoflavin had been withdrawn. On the other hand several authors have reported cure by means of motime and (Stannus 1940) of some of the lessons which have been ascribed to riboflavin deficiency. Further work may justify the separation of clinical pellagra into nicotine and deficience, ariboflavinous and perhaps other syndromes.

In a paper describing the ocular manufestations of ariboflavinosis Sydenstricker Sebrell and others (1940) said that these lesions develop early and that ariboflavinosis is possibly the most prevalent apparently uncomplicated avitaminosis Elsewhere Sydenstricker (1940 b) stated that recognition of superficial vascularizing keratitis depends upon

examination with the slit lamp

Dose —Synthetic riboflavin has been used by mouth subcutaneously and intravenously. No toxic effects have been reported. Neither the minimal effective dosage for therapeusis nor the maximal dosage have been determined.

A daily dose of 5 mg by mouth has been used with success by Spies Vilter and Ashe (1992) and [Ollife et al (1992) have given to mg daily by mouth Sydenstricker et al (1939) have used with benefit single doses of to mg and of 50 mg subcutaneously and of ro mg intrax-enously dissolved in 2000 cor of physiologies salt solution. In a subsequent paper Sydenstricker (1940 a) considered 3 mg to be the minimal dose by mouth and such that as much as 15 mg might be required for rapid improvement. For specific effect, it is necessary to use the pure synthetic vitamin because it is difficult otherwise to secture adequate thatak. He did not consider that suitable preparations for impection are jet available and he pointed out that all preparations of ribofican indeteriorate on exposure to light

Vitamin B of is another of the water soluble heat stable components of the utragenous base pyrchne which have been synthesized. It is a derivative of the mitrogenous base pyrchne which is also the fundamental ring structure in micotime acid. (Editorial Jour Amer Med Assoc 1939) Vitamin B of prevents dermaints in raits and anaemia in dogs (Bessey p 1937). Very recently the view has been advanced that B 6 is import than also for the nutrition of man. Spees Bean and Ashe (1939) be reported persistance of muscular weakness nervousness insomina and addominal perian in four cases of virtamin deficiency. Their patients had been kept on a deficient diet but had been successfully treated specifically for the other symptoms of pellagra and of beriber. The authors said that within four hours after the administration of 50 mg of pure synthetic vitamin B 6 in sterile physiologic solution of sodium chloride all patients expe

emphasize the importance of a well balanced, high vitamin diet for the treatment of pellagrins. They indicate, too, that substances other than incotinic acid are lacking in pellagra.

According to Spies, Bean and Stone (19.8) the administration of preparations of incotine acid to pellaginus causes pronounced improvement in most of the symptoms within 7 hours. The patient very some experiences a sense of well being the lesions of the microus membranes fade and show other agins of healing the appetite improves it hedgestive symptoms and diarrhoea decrease the mental abnormalities abate and for phytiutium; alministics or disappears. The skin lesions fade rapidly but the severer forms of dermatitis do not heal. Peripheral neuropathy is not relieved, but it yields to vitainm B i. The lesions shutch have been attributed to riboflavin deficiency may yield to riboflavin after failure with mostling and

Cobb (1030) has emphasized the value of mentione and not only for the psychoses of pellagra but also for those associated with acute or chrome alcoholism with arteriosclerosis or with other signs suggesting sensitive.

Riboflarin Lactoflarin, Vitamin B or C is one of the hest stable components of the vitamin B complex Flain is found in many plants and, in some of them it has been shown to be identical to riboflavin and, in some of them it has been shown to be identical to riboflavin and, in some of them it has been shown to be identical to riboflavin sometime of the stable of the performs some functions related to "the ordation processes of the cells" (Hogan 1939) Ottor possible physiological functions of riboflavin remain in doubt. In certain animals and probably in man riboflavin flamin) is stored in the liver, kidneys and heart. Rats on a diet inadequate in riboflavin the from defencescy of this substance e: en though considerable amounts still remain in the organs. Riboflavin is excreted in the turn of man bowever, even when the initiale is deficient (Emmente 1936 and 1937). Piboflavin is excreted also in human milk and in the milk of coss. The amounts so exercted are influenced by the riboflavin content of the diet.

The lessons which have been attributed to nboffs vin deficiency (p 1936) by Sebrell and Butler (1939) and by Spie. Bean and A-be (1939 a) are seen especially in cases of the type which has been called pellagra sine pellagra." Some of them have been designated by the term 'angular stomatitis. They are characterized by macerising of the skin or by serited fissures at the angles of the mouth. Reddening maceration deniadation or trains rese cracking of the lips is called chellist or chellows. In some cases also seborrhers accumulations occur on the mostrils around the nove and less often on the clus, on other parts of the face, or clse where on the body. The sebaceous glands appear to be plugged with a dry horny substance which projects from their ordices. The neighbor may skin may be darkly discolored.

Kruse et al (1940) have included in the picture of riboflavin deficiency a neculiar type of glossitis and certain ocular signs and symptoms. In

contrast to the fiery red color of the tongue of the pellagran they said that the tongue of budiavin deficiency has a purphish red or magenta hue IT is clean and the papillae are flattened. The corallar signs and symptoms include vasculutration of the cornea Levaturis resembling that seen in syphilis itching or burning sensations of the lids more or less photophobia and dimness of vision or partial bunders in poor light. These authors claimed that the lesions did not yield to vitamins A or C thamm or moc time and but that they were cured with riboflavin. In some cases they recurred after hoflavin had been withdrawn. On the other hand several authors have reported cure by means of nicotime and (Stannus 1940) of some of the lesions which have been ascribed to riboflavin deficiency. Further work may justify the separation of clinical pellagra into nicotime and deficiency ariboflavinous and perhaps other syndromes.

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menced dramatic relief of these symptoms and increased strength. The drug was injected, but whether intravenously or otherwise was not stated

Panfothenic Acid -- An article by Spies Stanbery and others (1940) concludes with the statement that their observations indicate that panto thenic acid is essential to human nutrition and that its function is probably associated with that of riboflavin

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Chapter XXXV

SCURVY

Synonyms —Scorbutus Barlow's Disease (in infants)
Definition —Scurvy is a disease of the tissues caused by deficiency of viamin C

Geographical Distribution—In the Tropics scurry is seldom seen except in laborers who have been removed from their usual environment and fed on diets consisting largely of creasis and canned foods. It has been common in the artitle regions except among Eshimos who like on their traditional dietary. Sporadic cales may be found in almost any part of the world.

Incidence —Neuther sex and no age group is exempt. In the past sextra has been common in labor camps in the Troptes on expedition to the Arctic, and on saling shaps which remained at sex for long periods of time. Outbreakes of scurvy have repeatedly followed failure of crops In the United States today and probably in other parts of the tempe are zone scurvy in adults occurs particularly among ill nourished individuals who live slone and who prepare most of their own meal. Under these conditions the diet is likely to be deficient in fresh fruits and vegetables Sporadic cases are to be expected in bottle fed infants who have not been given fruit juices. Diffusion of knowledge about the cause and prevention of scurvy, has greatly reduced the incidence of this disease.

ETIOLOGY

Scurvy is caused by deficient ingestion of foods which are rich in vita min C or by defective absorption of the vitamin from the intestine seems possible that advanced liver disease may interfere with the utiliza tion of vitamin C and thus favor the development of scurvy The ordi nary dietaries of natives of the Tropics and of the Arctic are adequate to protect against scurvy Vitamin C is readily destroyed by oudation When protected against oxidation it can withstand a good deal of heat Lightly broiled or roasted meat may retain much of this vitamin but boil ing is likely to destroy a large proportion of it. Paw fruits and vege tables particularly when fresh are nich in vitamin C Stefans on s observations among the Pskimos prove that meat and fish eaten raw even when putrid will prevent scurvy and that boiled meat has little protective power. He was inclined to believe that common salt when added to food favors the development of scurvy The evidence in support of this hypothesis is scanty However meat which has been preserved by means of salt doe not protect against scurvy The amount

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of vitamin C retained in canned or preserved food depends on the method of preservation. Some of the canned foods are said to retain nearly if not all the vitamin C originally present in the food.

Physiology—Heuronic acid solated some years ago has since been found to be identical with vitamin C. Since then it has been called ever tamic acid or ascorbic acid and it has been synthesized. Ascorbic acid forms colorless crystals which are soluble in water and in various alcohols It can be isolated only when protected from ovidation which destroys it.

As Wolbach (1937) has shown the functions of vitamin C are closely related to maintenance of the integrally of the intercellular substance to the formation of the bones and of the teeth and to the maintenance of cartilage and of fibrous tissue in a healthy condition. This vitamin seems also to play an important role in the growth of animals and of plants. The anaemia which may develop in scurvy seems to be caused by dysfunction of the blood forming tissues.

Man the other primates and guinea pigs cannot synthesize ascorbic acid (King 1030) but at least some of the other animals can do so vitamin is found in high degrees of concentration in the glandular organs and in rapidly growing tissues Human milk contains four times as much vitamin C as does cows milk. The quantity in human milk varies markedly with the diet of the mother A diet madequate in vitamin C causes marked reduction of this vitamin in the blood plasma and in the amount excreted in the urine Probably a daily excretion in the urine of 13 mg of ascorbic acid is close to the lower limit of normal and an output of about 40 mg indicates that the patient is saturated with vita min C (Sybil L Smith 1939) The work of various investigators indicates that the content of reduced ascorbic acid in the fasting blood plasma of normal individuals ranges from a minimum of about o 6 mg to a maximum of from r 5 to 2 mg or more per 100 cubic centimeters (S L Smith 1010) Friedman et al (1040) who studied the clearance of vitamin C at plasma levels varying from 0 og to 2 og mg per cent said that their results suggest that the clearance of vitamin C at the low plasma levels is constant

The need for vitamin C is intimately dependent on the rates of growth and of metabolism. Thus the infant requires correspondingly larger amounts of the vitamin than does the adult and increased amounts are called for in the presence of fever infection, or hyperthyroidism.

PATHOLOGY

The fundamental pathology of scurvy in man can be reproduced in monkeys or in guinea pigs. The specific lessons have been repeatedly described by Wolbach and his associates. The lessons are characterized by failure of the tissues to produce and to maintain the intercellular substances. These substances are the collagen of all fibrous tissue structures the matteres of bone dentin and caritage and all nonepithelial cement substance including that of the vascular endothelium. (Wollbach 1917)

Haemorrhages, large or small, may occur externally or internally in adults, petcehnace hemorrhages in the hair follicles of the lower legs large ecchymotic patches on the thighs or trunk and hematomata in the muscles of the legs are common Subperiosteal haemorrhages and extravassion of blood around the joints are more frequent in young children Secondary progenic infections are ecommon externally, and infected hematomation and form large abscesses

Darling Wolbach and others have described hypertrophy and dilatation of the heart as features of scurvy in man or in animals. Wess and Wilkins (1937) have expressed the view, however that these cardiac changes in man are to be attributed to coincident deficiency of vitamin B is rather than to lack of vitamin C. According to Wolbach calcium metabolism is not primarily disturbed but calcium is deposited in a characteristic manner at the epidiaphyseal junctions and in cartilage of joints. In advanced scurvy, the absorption of calcium from the bons leads to osteoporosis. Through resorption of the alveolar processes of the teeth and weakening of supporting structures the teeth become loose. In growing teeth, the formation of dentin ceases. Swelling of the gums and hemorrhages from them are common and hemorrhages from them are common to the support of the

In advanced cases, anaemia may become pronounced Oedema of the ankles is usually present. It may involve the face or even become generalized Effusion into serous cavities and particularly into the pen cardium are common.

SYMPTOMATOLOGY

The elimical picture of scurvy has been described in detail by Hessilethargy irritability and dizzanes. The appetite is lost and an inordinate craving for salt may develop. In more advanced cases pretechial hiemor hages appear around the hair follicles on the lower legs or large eachy motic patches may be seen on the thighs or on other parts of the body Swellings which may reach considerable size are caused by extravasation of blood into the larger muscles. Over these swellings there are patches are and use of the limbs increases the pair. Lesions of the eye the brain or the cord may result from haemorrhage into these structures. Recent studies by Alexander and Putnim (1937) of Wernicke's paralysis point to deficiency of vitamin B 1 as the cause of the minute haemorrhagic cranial leasons which characterize this disease.

Oedema of the ankles or of the lower legs is usually present. The face may become bloated and effusion into the pericardium or other serous

cavities may develop

External pyogenic infections such as hordeolum or boils are common and ulcers may develop on the legs. Large abscesses may result from infection of haematomata. The edges of the gums, except in edentitulous persons are denuded and reddened Later the gums become shollen blush and 's pongy. Fungating projections from the ulcerated surfaces.

partly cover the teeth Secondary infection gives the appearance of advanced pyorthea the breath becomes foul and the teeth become loose in their sockets. Loss of blood from epistaxis haematuria baematemesis or even from the tooth sockets may be considerable. Capillary oozing may be uncontrollable. The white count may fall gradually but the differential count is little changed.

Usually there is anaema. It may be caused by reduced activity of the blood forming organs or by loss of blood. Anaema occurs less often in children than in adults. In the latter it may be extreme. The complexion becomes sallow and muddy in appearance through increased pigmentation of the skin. The tongue swells and the salivary and the lymphatic glands increase in size.

Dyspnoes on evertion cyanosis of the lips tachy cardia and pulmonary congestion may develop. Slight extrition is often followed by sudden cardiac death even when the patient appeared comfortable while at rest. One may suspect that these cardiac symptoms are due to connectent deficiency of vitamin E (p. 1041).

In young children ecchymoses petechial baemorrhages and haema tomata in the muscles are seldom seen but haemorrhages about the joints and under the periosteum of the long bones are usually demonstrable Swelling in the epiphyseal region at the wrist and nodular enlargements at the costochondral junctions which resemble the rachitic rosary are to beerpected. In advanced cases separation of the epiphysis may occur.

The skin becomes dry and rough in scurvy. When the hand is passed lightly over the legs of the patient the papillary keratosis around the hair follicles is easily felt. Scurvy may account for clayed healing of a wound for the breaking down of an uber or for failure of a fracture to unite or may even be the cause of a fracture.

Vitamin C deficiency when it develops naturally in man is often associated with more or less deficiency of various other essential food factors. Ship benchen and Rand scurvy are combined deficiency diseases which show the symptoms of scurvy and of herber! Night blindness formerly regarded as an occasional symptom of scurvy. Is known now to be caused as a rule by deficiency of vitamin A. The keratosis seen in scurvy is not readily distinguishable from that of vitamin A deficiency.

DIAGNOSIS

In well marked cases of scurry dagmons is easy Nevertheless this disease has often been overlooked through failure to consider it as among the possibilities. Thrombocytopenic purpura leukaemia and mercurial possibilities. Thrombocytopenic purpura leukaemia and mercurial possibilities to disagnose these cunditions by positive evidence. On the other hand lead is said to combine so freely such ascorbic acid in the body that excess of lead may induce securely unless a large amount of the acid is taken. In cases of pyorbroes alwedans or of trench mouth the dietary bistory should be carefully investigated and if scurvy seems a possible diagnosis appropriate treatment should be natively.

The response to treatment with vitamin C, in cases of scury is so rapid as to be of great diagnostic value in doubtful cases. Low levels of unnary excretion and of blood plasma values for vitamin C seem to indicate deficiency of vitamin C. These findings occur frequently, honever, without other demonstrable evidence of scurvy and are of limited diagnostic significance. Capillary resistance tests are usually positive in scurry and they may be positive in the pre-corbitic stage of vitamin C deficiency. They have been reported as positive also in a notable proportion of apparently healthy and well nourished children whose deets were believed to be adequate in vitamin C. For this reason and because increased capillary fragility occurs in a number of conditions aside from scurry the diagnostic value of the capillary resistance test is small (Greene 1934).

Anaemia may be so pronounced as to mustead the climinan who is not familiar with this munifestation of scurry. Erroneous diagno es of rheumatic pain myositis or neurasthemia may be made in the earlier stages of scurvy.

In children, roentyenologic evamination of growing bones reveals characteristic lessions at the junction of the shaft and the epiphysis and often subperiosteal haemorrhages as well. Characteristic lessions at the costochondral junctions may be found in adults or in children

A test of the blood plasma concentration of ascorbic acid at a given time or of the twenty four hour exerction of this substance in the unne is of limited value for diagnosis. Saturation te is for which large amounts of ascorbic acid are administered and the exception in the unne determined quantitatively for a definite period, are more significant by standard method has yet received general acceptance. The methods used were discussed by Sybil I. Smith (1939) and some of them were tested by Crandon, Lund and Dill (1940).

Prognosts is excellent in uncomplicated cases provided that treatment be begun in time and that the patient be kept at rest until convolescence is well established. In intreated cases, death results from exhaustion cardiac failure or intercurrent infection. In young children broncho pneumonus sant to be the immediate cause of death.

PROPRYLAXIS

The main points in the prevention of curvy follow directly upon what is known of etiology and treatment. Nother the optimal nor the minimal daily requirement of vitamin C has been determined with certainty. As a result of their experiments on three adult males, Ralli and associates (1930) have stated that a blood pla-ma concentration of 1 or mgn per cent can only be obtained and maintained on a daily intake of at leat too mg of vitamin C. They suggested that this be considered the optimum intake.

Sybil L Smith (1938) said that The estimated requirements for various age groups as reviewed he within the following limits of absolute values Infants from about 8 mg (nearly born) to 50 mg daily children from 22 to 100 mg or more adults from 28 to 100 mg or more With due allowance for unlike methods followed in their determination these values may be considered to represent roughly the range from the physiologically indispensable minimum to saturation or livius consumption. Values of about 20 mg daily for infaints 40 mg for children and from 50 to 60 mg for adults may be considered as tentative estimates for the middle or barely adequate consumption level with but little margin of safety or allowance for individual variations in requirement.

Growth pregnancy lactation and other conditions which elevate the metabolic rate increase the requirement of the body for vitamin C According to Chandler (1939) recent estimates of the vitamin C require ment for a pregnant woman run from 75 to 125 mgm and for a nursing

woman from 100 to 150 mgm per day

There are indications that the requirement for vitamin C is increased by diarrhoea in tuberculosis in certain cases of liver disease after surgical operations and by the ingestion of excessive amounts of lead. Ascorbic acid combines readily with lead so that painters tend to develop scurvy. On the other hand by taking large amounts of vitamin C they can to some extent protect themselves from lead poisoning (Chandler 1939)

TREATMENT

As a rule all the symptoms of scurvy respond promptly to adequate dietary treatment. Much relief is to be expected within from two days to a week. Therefore it is seldom necessary to administer vitamin C in pure form. The diet should supply not less than 500 mg of ascorbic acid an amount which is contained in a pint of fresh orange juuc.

Little positive information is available about the absorption and storage of vitamin C. It is believed however that absorption takes place thickly in the small intestine and there is evidence indicating that absorption is occasionally defective. Therefore should a patient fail to respond to the usual dieraty freatment it may be necessary greatly to increase the vitamin. C content of the diet or to administer with it a pure preparation of ascorbic acid in considerable amounts.

Ascorbic acid can be administered in tablet form by mouth intra muscularly or intravenously. Ascorbic acid should be administered by one of these methods when adequate amounts of vitamin C cannot be ingested in the form of food.

According to New and Nonofficial Remedies (1939) 10 mg of pure ascorbic acid daily is a protective dose for an infant. The thera peutic dose is 30 to 50 mg daily but the requirement in certain cases may be considerably higher. Sodium ascorbate is recommended for parenteral injection in concentrated form when vomiting diarrhea or other conditions prevent utilization of the vitamin by mouth in adequate amounts (New and Nonofficial Remedies 1939)

Repeated doses of as much as x to 6 Gm of crystalline vitamin C have been administered orally or intravenously to adults without producing

toxic effects (Abt and Farmer 1939)

SOURCES OF VITAMIN C.

General information about the occurrence of vitamin C in food has been given already (p 1074) The short list which follows shows the usual vitamin C content of a few common foods

APPROXIMATE ASCORBIC ACID VALUES IN MILLIGRAMS PER OLYCE OF FOOD AND PER

TIST OF MILE				
			Μg	:
Citrus fruit juice	18	to	20	
Tomatoes or tomato juice	8	to	10	
Greens properly cooked	5	to	19	
Raw green peppers			50	
Fresh raw vegetables	5	to	10	
Cooked fresh or canned vegetables	2	to	\$	
Potatoes properly cooked	3	to	5	
Pineapple and strawbernes fresh			8	
Pineapple canned or juice			3	
Apples and most other fruits		5 to	3	5
Pasteurized milk per pint		3 to	6	

Among the richest food sources of vitamin C are oranges lemons grape fruit (raw or canned) tomatoes (raw or canned) green peppers raw cabbage and other green, leafy vegetables Dry cereals and legumes are devoid of vitamin C, but almost any kind of seed if kept moist until it sprouts will become an effective antiscorbutic. The vitamin C content of fruits increases as they approach maturity but pears and green corn show a bigber content of this vitamin during the tender stage Certain varieties of the same kind of fruits and vegetables are richer in vitamin C than are other varieties

According to Abt and Farmer (1939) canned tomato juice and the

canned suices of citrus fruits are rich in vitamin C

Storage and Preservation -Time and warm temperatures have deleterious effects on vitamin C
about half of its vitamin values

Wilted spinach for example has lost
Potatoes and other root crops lose the vitamin but slowly under usual conditions

Although quick freezing is believed to have little effect on the vitamin C value of fruits and vegetables shelling washing and blanching are said to reduce it materially and traces of copper salts which are used for spray

ing fruit and vegetables will quickly destroy the vitamin

Drying per se does not destroy vitamin C but oxidation usually does so during the process of drying Dehydrates foods are usually devoid of vitamin C for the same reason Pickling salting curing or fermenting usually eliminates vitamin C

Cooking and Canning -Contact with copper vessels access of air prolonged heating and alkalimity are to be avoided in cooking or canning An acid medium tends to conserve vitamin C

· Letaming in Human Nutrition A C Chandler The Rice Institute Pamphlet tol 26 1030

то8т SCITEVY

When crushed or shredded in the raw state vegetables such as spinach cabbage or turnips lose much of their vitamin C through liberation of enzymes It is well to start the cooking of vegetables in hot water because these enzymes are then quickly destroyed. The addition of soda to the tooking water tends to destroy vitamin C

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SECTION V

DISEASES NOT SATISFACTORILY GROUPED IN OTHER SECTIONS

Chapter XXXVI ACUTE EFFECTS OF HEAT

GENERAL INFORMATION

Classification —Acute effects of heat in man are manifested by reat tions which may be mild or severe. Any classification of the clinical types of response to heat is necessarily ribitrary because of the evistence of numerous borderline cases. Three principal categories of cases, based upon outstanding symptoms and differing in their mechanism of production are commonly recognized namely heat exhibit on in which prostration is associated with a body temperature which is subnormal normal or but little elevated heat pivers, in which the temperature is considerably or extremely elevated and heat cromps in which cramps in the muscles dominate the nexture.

Because nomenclature is chaptic and criteria for diagnosis differ and because cases of borderline character are numerous reliable data on the relative frequency of the various chincal types of response are rot

available

Physiological Responses to Heat—In general, exposure to heat causes increase in the rate of the pulse and of the respiration and a consequent diminution of ability to perform muscular work. Siecating is usually profuse but cessation of sweating may precede the onset of high fever. The cause of this cessation has not yet been determined. Some authors believe and others deny that dehydration of the body or marked dryle tion of sodium chloride in the blood are causative. It is generally conceded, honever, that adequate ingestion of fluid favors sweating and it has been demonstrated that heat cramps can be prevented or cured by administration of ample quantities of sodium chloride. The sodium and the chloride in the blood can become depleted as a result of prolonged and profuse sweating repeated womating or persistent diarrhoea. Dehydra tion can result from the same causes or from madequate ingestion of water. The carbon diarrde combining power of the blood may be reduced by exposure to heat. There is pronounced disagreement among observers.

as to the occurrence of many of the other metabolic disturbances which have been reported in cases of heat pyrexia

Heal loss in man occurs through conduction convection radiation or vaporization at atmospheric temperatures below that of the body. At higher atmospheric temperatures vaporization of sweat becomes the chief means of dissipating excess of heat. Air movement over the skin favors dissipation of heat but high atmospheric humidity interferes with heat loss by vaporization

Adaptation or Acclimatization — Constant or frequently repeated exposure to heat hings about increase in the power to sweat and a reduced excretion of sodium chloride in the sweat. These changes can develop within a period of two weeks or less. They may disappear in an even

shorter time after cessation of the exposure to heat

Geographical Distribution —According to the experience of Castellani and Chalmers (1979) beat pyrcua (heat stroke) is the usual form of response to excessive heat in the tropics. They have called attention to the special prevalence of heat pyrcua in certain parts of India including the Northwest Provinces and to its comparative scarcity in Ceylon Biggam (1942) in the disembarkation of troops in the Red Sea observed occases among which there were 8 deaths.

Cases of heat pyrexus were very numerous twentry years or more ago in the British and Prench solders in other colonial possessions in the tropics. Regulations since promul gated in India have greatly reduced the incidence of these cases. French statistics examined a few years ago (Shattuck and Hilferty 1936) showed that for many years three have been few deaths from heat in the French colonial possessions. It was found also that deaths attributed to heat were notably common in the United States in Australia and in India Figures obtained from Central America. South America. Africa and Asia were inadequate as a basis for sound generalization. Naval and manne personnel on shipboard in the tropics and stokers particularly are frequently attacked by heat pyreans or overcome by heat et-dusation.

In the United States deaths from the effects of heat were far more common in urban than in rural communities. They were especially num erous in the larger cities of the Northern States where they occurred chiefly in July and August during heat waves of several days duration

Until the means of preventing them became known heat cramps were common in the United States and elsewhere among men doing hard physical labor while exposed to great heat Cases of heat cramps occur occasionally in the tropics and elsewhere in association with heat pyrexia

PROPIINLANIS

Suscepthility—The power of individuals to become acclimatized to heat differs. In general bodily vigor and adaptability of the circulatory system reduces susceptibility. Persons who have organic disease of the heart or kidneys of a character which sensonaly impairs the function of these organs should be advised not tog to the tropics should he given to persons who have hyperthyroidism or ichthyosis or whose power to sweat is defective.

Individuals who bave been living in a temperate environment should be especially cautious, at first about exposing themselves to great heat in the tropics or elsewhere Important physiological adjustments usually take place within a period of about two weeks or less after the beginning of exposure to unusual heat.

There are indications that natives of the British Isles are more susceptible to heat than are other races. According to Stott (1936), Indian troops in Mesopotamia very rarely showed acute heat effects. In 50 percent of such cases malana was considered to be the exciting cause

Housing—In hot climates buildings should be designed to protect against the sun and to provide for good ventilation and free air movement. A double roof, having a well ventilated air space is useful. A tent pitched in the sun should always bave a fly above it. A thatched roof is cool but cortrigated iron becomes very bot when exposed to the sun and heat penetrates it freely. Trees and vegetation around a dwelling not only provide shade and reduce reflected light but they cool the atmosphere by promotting the evaporation of mosture. Massive walls above heat slowly. Venetian blinds, awnings, punkas and electric fans are useful adjuncts.

Hours of work should begin early Either they should end at noon or work should be discontinued between noon and three or four o clock in the afternoon Physical exertion in particular should be avoided whenever possible during the botter hours of the day The tempo of work should be less than in temperate climates and great fature is to be avoided

Exercise and Rest—Sedentary workers beneft greatly by regular exercise taken during the cooler hours of the early morning or late afternoon. A rest period during the hours of greatest heat is to be recommended.

Food and Drink —The ordinary rules of bygiene should be more scrupulously followed in the tropics than in the temperate zone

As to diet it may be desirable to restrict starches and sugars which are

As to diet it may be desirable to restrict starches and sugars which are heat producers but proteins may be eaten freely. Aleoholic beverages are strictly to be avoided until alter sundown. Water and common salt should be taken much more freely than is necessary in cool weather. (See Heat Cramps.)

The Division of Occupational Hygene of the Department of Labor and Industries of The Commonwealth of Massachusetts (Leafet No. 154 July 1939) recommended that, with the beginning of hot weather, sait should be applied liberally to food at the table and added to drinks such as tomato junce. Approximately 2 teapondus of sait should be taken daily in hot weather by workmen and by all persons who perspire freely Those doing sedentary work may require only 1 teapondul in addition to that contained in the diet. Lake precautions might well be taken by recent arrivals in the tropics.

Clothing —In parts of the tropics where heat is continuous and where the fluctuations of temperature are not pronounced the nearly naked savage exemplifies the ideal in clothing Clothing should be of very light porous maternal which will absorb perspiration and favor its evaporation by admitting air. Shorts and short sleeved shirts open at the neck and worn without a tre air to be recommended for coolness. All clothing should be loose. If worn in the sun it should be white or of very light color. Starched clothing is relatively impervious to air and therefore does not fulfill the requirements. The waistcoat should be taboo and it is well to dispense with the coat when circumstances permit. The need for protection against insects or against rapid changes of temperature which occur in some parts of the tropics may modify the clothing requirements.

Some Europeans have been able without injury to expose their heads repeatedly and for hours at a time to the direct rays of a tropical sun Nevertheless use of the helmet which shades the eyes and the nape of the neck and which by its detached head band permits circulation of air around the crown of the bead can confidently be recommended as the best type of headgear for protection against the sun's rays. It is well to wear the helmet even when the sun is obscured because some of the heat rays may have considerable power to penetrate clouds. Helmets are seldom worn in the islands of the Pacific or in the Amencian tropics but umbrellas are often carried in the Philippine Islands. The sun is feared far less in the selocalities than in India or in the British and French posses sons in Africa and in the Far East. The reason for these marked differences of experience and of custom are by no means clear.

Air conditioning if not carried too far undoubtedly has value for the prevention of acute heat effects. The best methods of using it for the purpose have not yet been definitely established.

Heat Pyrexia

Synonyms — Thermic Fever Heat Hyperpyrevia Heat Stroke Sun Stroke Sun Traumatism Sinasis

Definition—Heat pyrema is a condition characterized in severe cases by high fever and associated symptoms which have been caused by exposure to excessive heat Circulatory collapse and coma may develop in the advanced stages.

Incidence—All ages both seves and all races so far as is known are subject to heat pyretus. Men are more frequently attacked than are women. The highest death rates occur among infants and elderly per sons and the lowest among children and young persons. Where death rates of men of working age are relatively high they are influenced by occupational factors. Urban death rates are constantly high as compared with those for rural areas.

In the southern United States deaths from heat pyreua are more common among Negroes than among White (Shattuck and Hilfert) 1033) This can be attributed to the fact that in the South the Negro does most of the heavy manual labor. In the large northern cities of the United States heat pyreua is a common cause of death after a series of unusually hot days in July or August

Although proof is lacking there are indications that natives of the British Isles are more liable to heat pyrevia in the tropics than are mem bers of other races of western Europe Recent arrivals in the tropics in particular, are subject to this disorder

ETTOLOGY

When the cooling mechanisms of the body fail to dissipate excess of heat which is generated from within or acquired from without, the tem perature of the body rises Heat pyrevia commonly develops after pro longed exposure to excessive environmental air temperatures Other atmospherical conditions which may contribute to its causation are high relative humidity and absence of air movement Cessation of perspira tion has often been observed in advance of an attack of heat pyrexia cause of this phenomenon is by no means clear It is known however that ingestion of adequate amounts of water favors perspiration and that the power of individuals to perspire freely varies greatly

Among important factors which may be operative in the production of heat pyrevia are strenuous physical evertion heavy or tight clothing which does not allow free access of air to the skin ill ventilated housing, the ingestion of alcoholic beverages the lack of physiological adaptation to heat, and debilitating diseases

It is no longer believed that the ultra violet rays of the sun are impor tant in the causation of beat pyrevia, but that the longer heat rays, which have greater penetrating power, are significant

Some of the prodromal symptoms such as headache nervous irri tability and intolerance of light can undoubtedly be aggravated or even induced by exposure of the eyes to brilliant sunlight whether direct or reflected

The mechanism of the circulatory disorders caused by high body tem peratures induced by exposure to heat has not been adequately explained On the basis of animal experiments bowever Derohert (1030) reached the conclusion that the essential phenomena of heat stroke are to be accounted for by the disintegration of protein. He regarded the heat stroke syndrome as closely related to anaphylactic and protein shock

PATHOLOGY

Body temperature may continue to rise after death Rigor mortis sets in early Decomposition proceeds rapidly The blood shows little tendency to coagulate and the blood and tissues may show increased acidity The organs in general are congested The left ventricle of the heart is often firmly contracted but the right ventricle may be dilated Engagement of the lungs is sometimes so marked as to render them almost black E E Smith (1928) said there is interstitial pneumonitis Occa sionally the mucosa of the stomach and of the intestines is swollen Minute haemorrhages may be found in the skin the internal organs and Signs of congestion occur in the vessels of the meninges the the brain Signs of congestion occur in the vessels of the meninges the brain and the medulla Wilson (1940) in addition to petechiae in the central nervous system found in 4 of his cases a fairly extensive haemor rhage of the ventruclar septum in the region of the bundle of His. Intracerebral and spinal fluid is apt to be increased in amount. Coagulative necrosis of cells has been observed in some of the cells of the central nervous system. Cloudy swelling may occur in the myocardium the liver and the laddon's. Enlargement of the spleen when present appears to be attributable to causes other than heat.

SYMPTOMATOLOGY

Cessation of sweating may occur as much as 48 hours in advance of the attack. Mild prodromal disorders such as listlessness muscular weak ness headache vertigo anorema pronounced thirst and slight increase of body temperature and of pulse rate usually precede the onset of high fever but further development of symptoms may not occur.

Among other symptoms which have been observed are suffusion of the eyes photophobia chromatopsis urntability of the bladder. Scantiness of the urine may occur. Probably it is an indication of dehydration. Some authors assert that urine is usually passed in considerable amounts. Nausea or vomiting precordial distress a sense of impending calamity muscular twitching and manifestations simulating hysteria have also been recorded. There may be a short period of restlessness or of irritability and unressonableness.

A sharp rise of body temperature to 105 Γ 110 Γ or even higher supervients suddenly It may be accompanied by delirum and it is followed by cyanosis and somnolence deepening into coma. There may be more or less muscular rigidity. Coavolisions or o rounting are common concomitant symptoms of grave import. A person attacked during the might may be found dead in the morning

Irregularity of the breathing or the Cheyne Stokes type of respiration are grave symptoms. The pupils are contracted until the terminal stages when they become dilated. The knee perks and pupillary refleres are usually diminished or abolished. The pulse at first raind full and regular and of increased tension becomes small feeble and irregular Cyanous and clammines of the skin appear as late symptoms. Death has been variously attributed to stopping of the heart and to failure of the resourcition.

During the attack the urine generally contains albumen and the chlorides are markedly reduced. The spuril fluid is clear but the pressure is usually increased. Constipation is the rule but heat pyrevia may be associated with profuse vomiting or with cholera like darchoca. Heat cramps develop in some of these cases through depletion of sodium chlorid. Very profuse sweating may have similar effects.

In cases which recover the temperature falls rapidly diuresis occurs the pulse improves and the patient sleeps Resumption of sweating is a favorable sign. The fever and other symptoms may recur within a few hours after successful treatment of the primary attack. There may even be several such relapses

Although proof is lacking, there are indications that natives of the British Isles are more hable in heat pyrema in the tropics than are members of other races of western Europe Recent arrivals in the tropics in particular are subject to this disorder

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intervals while air movement is maintained by fanning are alternative methods of reducing temperature. Meanwhile the patients temperature should be taken at intervals of every few minutes. Rectal reading-are best everyt when colonic irrigations are being used. False their mometer readings caused by high atmospheric temperatures are to be guarded against. During treatment the patient's temperature usually falls rapidly and it continues to fall for a time after the cooling procedures have been discontinued. To prevent the temperature from reaching subnormal levels the cooling treatment should be stopped promptly when the patient's temperature has fallen to 10 or 103 F. The patient should then be wrapped in a beht dry blanket.

Lest high fever supervene mild cases should be treated promptly by rest in a cool and arry place cool baths and free meestion of fluid. The patient's condition should be closely watched until the symptoms have abated.

According to Marsh (1930) excellent results in the treatment of heat cases have been obtained by the Anglo Persian Oil Company which oper ates in South Persia. In their bospitals cases of heat pyrevia are treated in special wards in which the temperature is Leptat 65; F and the humidity is maintained at a low level. All cases of fever occurring in outlying stations are placed during the heat of the day in a cold storage chamber attached to the local ice plant. During the coolest part of the night they are quickly transferred by ambulance to the nearest hospital

The mechanism of the circulatory disorders of heat pyrevia is not well understood. Quickly acting cardiac stimulants such as aromatic spirits of ammonia and injections of camphor or of strophanithin are believed to be valuable when pulmonary congestion or other signs of cardiac embar rassment east. When there is \$2,anosis venus engorgement and marked pulmonary congestion venesection may be beneficial. Caffeine may be helpful as a circulatory stimulant. Although frequently recommended in the past strychnine is probably of no value as a circulatory stimulant.

Dehydration may well be an important factor in the causation of some of the causation of the c

Light chloroform anaesthesia is frequently employed to control con vulsions. Morphine has been used for this purpose but not always with success. When the cerebrospinal fluid pressure is increased withdrawal of fluid by lumbar puncture may be desirable.

If the presence of malaria has been demonstrated or even suspected injections of a suitable quinine salt in adequate dosage is imperative

Prophylaxis - The precautions to be recommended in general have been outlined on page 1083 1088 DIAGNOSIS

COMPLICATIONS AND SCOULLAE

Owing to the pulmonary congestion incidental to heat pyreua broachopeumonia is a common and dangerous sequel. The power to sweat may remain in abeyance for three weeks or longer after an attack of beit pyreus and the knee jerks may not return for some time. These phe nomena are indications for continued causing.

When moderate fever persists for some days intercurrent infection is to be suspected. Headache, photophobia, and giddiness may continue for a week or more. Cerebral or cerebellar symptoms are among the senious sequelae. Usually they disappear gradually. It has been commonly observed that persons who have suffered even midly from the effects of heat may remain abnormally susceptible to it for many years thereafter.

DIAGNOSIS

Circumstances give presumptive indications of the nature of the malady. An attack of permicious malaria may simulate heat pyretus or vice versa. The hading of malarial parasites in the blood indicatis that malaria may be an important factor although not necessarily the sole cause of symptoms. Failure to find parasite in the peripheral blood however does not exclude suhtertian malaria. Splenic enlargement when present is likely to be of malarial origin. The hot dry skin and high fever differentiate heat pyrexa from heat exhaustion. Meningitis enteric fevers, and pneumonia should not be overlooked. Uraemia and another vare usually afsignit.

Prognosts depends on the degree of seventy of the symptoms the promptness and efficacy of the treatment the age of the patient, has related to renal disease acute or chronic alcobolism or precusing debility from any cause militate senously against recovery Percentage mortally rates are dependent upon many variables. In hospitalized cases, they range from about 15 to about 50 per cent. The prognosis is excellent in

mild cases in which high fever does not develop

TREATMENT

When there is high fever the essentials of treatment are rest rapid returnation of temperature, replacement of lost fined cardiac or circulatory stimulation as indicated by the symptoms and, sometimes control of convulsions. The patient should be placed at once in a recumbent position in the coolest available place. I rec circulation of fresh air is important. The clothing should be removed.

To reduce temperature, rubbing with ice and colonic injections of ice water have been recommended but these procedures may be too drastire. Sponging with cold water accompanied by vigorous finction applied to the skin wrapping the patient in a wet sheet which is sprayed with water at

TREATMENT

In general rest and supportive treatment are required. Clothing which might imped the circulation should be loosened. The patient should lie quietly in a shady place where there is free circulation of air Strong drafts are to be avoided.

If the body temperature is subnormal the patient should be wrapped loosly in blankets and hot water bottles should be applied to the feet. Hot tea aromatic spirits of ammonia or whiskey may help to relieve the patient. A hypodermic anjection of caffeiner or of a preparation of digitals may be required. Although frequently recommended strychnine is useless.

PROPHYLAXIS

The general indications have been outlined on page 1083 McCord and Fernhaugh (1923) believed that pathological fatigue or exhaustion in soldiers following upon physical evertion under unfavorable conditions of heat and humidity can be caused by excessive loss of water and of chioned through sweating For the prevention and control of pathological fatigue they recommended the use of safinized drinking water 0.8 to 10 per cent

Heat Cramps

Synonyms — Miner's Cramps Stoker's Cramps Cane Cutter's Cramps Firemen's Cramps

Definition.—Painful spasms of the voluntary musculature following muscular activity in a high environmental temperature (Talbott 1035)

Incidence —Data on the distribution and prevalence of heat cramps are scanty. Talbott (1935) said that the incidence of heat cramps is high in industries in which large numbers of men do hard muscular work in high climatic or environmental working temperatures. When hot weather succeeds a period of cool weather cases of heat cramps among working begin to appear promptly whereas cases of heat exhaustion succeed after several days of heat.

ETIOLOGY

Cases of heat cramps occurring in the steel industry in Ohio develop chefly in the summer months. Thus the incidence of these cases depends in part on high environmental temperatures incidental to certain kinds of labor and in part on the high chimatic temperatures of seasonal origin Heat cramps may be common where the relative humidity is high or low Relative humidity therefore is of secondary importance as compared with temperature

Deficiency of sodium and of chloride appears to be the essential cause of that cramps Much sodium chloride passes out in the sweat of persons who have not become adapted (acchimatized) to hard labor at high tem

By preliminary exposures of new mine workers to greater degrees of heat than those to be encountered by them under working conditions Dreosti believed that some degree of acchimatization and resistance to the ill effects of heat could be induced (Dérobert 1030)

Heat Exhaustion

Synonyms -Heat Prostration Heat Syncope

Definition -Heat exhaustion is a certain type of response to exposure to excessive heat The condition is characterized by prostration and con comitant circulatory disorders which are associated with little if any rise of body temperature

ETIOLOGY

The climatic causes of heat exhaustion are the same as those of heat pyrevia. Under identical external conditions heat exhaustion may develop in one individual and heat pyrevia in another. Probably the type of response to heat is determined by physical condition fatigue alcoholism, or the existence of intercurrent disease. Chronic circulators disorders debilitating di eases the ravages of age and fatigue resulting from unaccustomed physical exertion predispose to heat exhaustion

PATROLOGY

The pathology of heat exhaustion is not characteristic. The lesions are those consequent upon circulatory failure

SYMPTOMATOLOGY

Semptoms usually develop rapidly ometimes suddenly Among them are weakness, nausea headache giddiness and staggering In attempting to walk the patient may fall and he may even lose conscious. ness There may be an initial rise of temperature to 100° or 102 F More often the temperature is normal or subnormal A sickly pallor, a low blood pressure with a small weak and rapid pulse, dilated pupils and a moist clammy skin are the rule

Mild cases recover rather promptly under rest alone but deaths due to circulatory collapse are not uncommon. The nature of the circulatory disturbances appears to be variable but the picture more often resembles that of shock than of cardiac decompensation

Diagnosis may require exclusion of acute alcoholism, uraemia apo

plexy, epilepsy and opium poisoning

Prognoss: is favorable except in the presence of serious intercurrent disease and particularly when there is significant pathology of the circulatory system or of the Lidneys

Heat exhaustion is often reported as a secondary cause of death in the elderly and in persons debilitated by disease or recovering from operative procedures

Nocturnal cramps in the limbs when not related to exposure to heat gastric crisis and colic of digestive origin are to be differentiated from heat cramps

After the cramps have ceased it may be possible to confirm a diagnosis of heat cramps by reproducing them in the affected muscles. Direct pressure upon these muscles is le s reliable for reproducing cramps than is counter pressure applied to a fieved limb. Among other methods of inducing cramps are the amplication of cold water or evolvence to cold are

Prognosis — Death is rare in the absence of serious organic disease or of heat pyrena. The rapidity of spontaneous recovery during rest depends upon the severity of the symptoms. Severe cramps recur for many hours unless checked by appropriate treatment.

TREATMENT

Treatment requires rest restoration of the sodium and chloride content of the blood serum to the pormal level and correction of anhy drema by replacement of body fluid. Intravenous injections of normal salt solution serve both purposes. Administration of sodium bearbonate or of detrose in normal salt solution has been advised. Talbott (1935) doubted their value on the ground that the benefits implificate caused by the salt solution alone. He administered 600 to 1000 cubic centimeters of salt solution by the intravenous route during the first six hours and repeated it if the patient were markedly hydremic. Relief from cramps occurred in all of his cases before the end of the mittal influsion. The intravenous route was considered the method of choice until the patient was able to take salt by mouth.

Salt can be given by mouth as milk as normal salt solution or in the form of tablets. The dose recommended for the latter was one tablet of r.Gm. (15 gr.) every hour during the daytime until 15 tablets had been taken.

y Substantial of fluid in amount sufficient to compensate for losses by sweating or otherwise is beneficial but of less importance than is replacement of salt

PROPHYLAXIS

Maintenance of good health is important as a preventive Adequate rest and a wholesome nutritious diet are means to this end

The best method of preventing heat cramps in workmen is to provide them with an abundant supply of drinking water containing sodium chloride Bock (quoted by Tallbott) recommended a concentration of 0 to 0 is per cent in the drinking water. He said that when taken cool such water had no perceptible salme taste and that it alleviated thrist McCord and Ferenbaugh (1931) found that stronger solution tended to increase thrist.

Talbott (1935) estimated that an average negestion of 15 Grams (225 gr.) of sodium chloride daily is probably necessary for men engaged in hard labor in hot weather. It has long been a custom for coal miners

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peratures On the other hand after adaptation has occurred the per centage of sodium chloride in the sweat is comparatively low. Deficiency of sodium chloride may be brought about or aggravated through loss of this substance by vomiting or diarrhoca or by inadequate ingestion of the salt. Among conditions predisposing to heat cramps are lack of appetite ill health unbygenet bring and acute alcoholism

Exposure to heat causes at first a dilution and then a concentration of the blood. At the stage at which heat cramps appear there is apt to be an increased concentration of serum protein (globulin) resulting from anhydremia of the blood. All of the electrolytes in the blood serum except the bicarbonate ion may, show variations from the normal but decrease of sodium and of chloride alone seems to bear a significant relationship to the symptomic (Tallbott 1035)

PATHOLOGY

Little is known of the pathology of uncomplicated cases of heat cramps because deaths are few In some of the fatal cases the heat cramps have been associated with heat pyrevia a condition which is a frequent cause of death (Smith 1028)

SYMPTOMATOLOGY

Heat cramps are usually manifested in the muscles of the extremutes. The cramps may be so slight as to mole only a few small muscles or they may occur in most of the skeletal muscles. They are transitory and they tend to recur at longer or shorter intervals in proportion to their seventy. When cramps are slight a man may be able to continue his work. In cases of moderate seventy, the condition is disabling and in severe cases the pain is extremating.

The distribution of the cramp is usually symmetrical. They are manifested especially in the muscles which men use most in the work Generally the onset is gradual. Slight spasma are succeeded by cramps which increase in severity until after recovery, has begun. It is doubtful whether heat cramps ever involve the amonoth muscles of the abdominal viscers or the heart muscle. Smith (1928) believed that they can and Talbott (1924) that they do not occur in these tissues.

Marked increase in pulse rate respiration rate or temperature and alteration in the deep releases or in the papillary reactions are not sympto matic of heat cramps. When present these symptoms are attributable to other causes. Constipation is the rule. Vormiting occurs occasionally and durrhoos occurs rarely.

DIAGNOSIS

Evidence of exposure to unusual heat combined with mu cular exertion employment in an industry which involves hard labor and exposure to heat or a history of previous attacks in per one so exposed may point to a diagnosis of heat cramps. The physical examination is essentially negative.

Chapter XXXVII

TROPICAL ULCER (TROPICAL SLOUGHING PHAGEDENA)

Synonyms - Ulcus Tropicum Aaga Sore

In many parts of the troptes one encounters a very great number of ulcerative processes of the skin These lessons may be associated particularly with the presence of Sprochaeta polluda or of Sprochaeta schaudium; and of Bacilliu lepton or Listimanus tropta. More tarely ulcerative lessons are encountered which are associated with Sprochaeta pertensus infection or are of blastomycotic or sportcribal character Granuloma inguinale and lymphogranuloma inguinale are also not infrequently observed in some localities.

Other cases of ulcaration may be explained by infections with ordinary progenic organisms of the skin which are enabled to get a foothfold in an abrasion or other minor wound in a person whose resistance has been reduced by such cachera producing diseases as mafaria dysentery or anxiptiostomiasis Indeed some authorities attach special importance to the tibial ulcers found in advanced cases of hookworm disease. Some of the sores may be primarily due to irritating applications used by the natives of many countries as setons. In other instances the sores may result from neglected wounds.

It therefore seems clear that the chronic dicerations of the skin observed in the tropics may have at times a very different ethology. However investigations during many years in different parts of the tropics seem to show that there is one very common form of diceration howns as tropical sloughing phagedena or tropical uiter that may be regarded as at least a climical entity and that has been reported in a few instances to have given.

rise to epidemic proportions

Geographical Distribution—It is the commonest form of ulcration in Amazonia and is also very common in most other countries of tropical South America. In Asia it prevails especially in India Indo China Southern China and the Flishppines. In most parts of Africa it is common. The writer found it also particularly in the Belgian Congo and in Tranganyita. Corkhill reports its prevalence in the Sudan and Brennan Anderson and Roberts in Kenpa Colony. It is said to be the commonest cause of disability among laborers in Malaya and James (1938) has emphasized that it is a terrible scourge in the islands of the southern Facific throughout Melanesia and especially in New Guinca and the Solomon Islands where he studied 892 cases. Manson Bahr (1940) points out that it has occasionally assumed epidemic proportions. James (1938) refers to epidemics of south ulcra especially in New Britain Melan

in England to add salt to their beer and it is said that those who drink salted beer do not suffer from heat cramps Stokers on vessels sometimes take sea water for the same purpose

Men who are newly engaged for heavy work in a hot environment should be protected at first by restriction of labor and by liberal ingestion of salt. The same is true of workers in general when a heat wave succeeds upon a period of cool weather.

REPERFNCES ACUTE PRECIS OF HEAT

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the organisms on a potato extract medium. The latter found that the sorral forms occurred rarely on this medium.

Tunnichff and Hammond (1934) have studied the rough colonic of fusiform bacilli and have presented additional evidence to support the opinion that the fusiform bacill, and spirilla are different forms in the life cycle of one organism. Smith (1932) states that he has repeatedly seen spiral forms take the place of fusiform bacilli in pure culture and seen fusiform bacilli, the cycle into spiral forms.

For convenience of description the two forms are described separately Sprachesta vincent (S selvadumi) (Lordica incient) is a slender delicate spirillum with a variable number of shallow and irregular undulations. In dark field preparations from the lesions they are actively motile. They stain readily with any of the silver impregnation methods (Fontana stain) and with Girmas a stain but may also be demonstrated by sightly overstaining with diulte carbol fuchsin (r-g) or Loeffler s methylene blue

Bacillus Intiformus is a coarse plump fusiform rod. The rods average from 5 to 7 µm heigh but many vary bevond these limits in the same preparation. They may be straight or slightly curved and the ends taper to a sharp of dull point. In standed preparations they are characteristically beaded or banded. They can be demonstrated with ordinary bacterial status and are generally Gram negative. They have been described as non motile but in some types a definite and even active motility has been observed.

Tusosprochaedosis—In addition to tropical ulcer the spirochaetal and fusiform organisms are found in small numbers in the mouths of many normal adults particularly around the ginguyal margins and in the tonsillar crypts. They are very numerous in the pseudo metabranous ulcerative inflammations known as Yincent a singina and Vincent is stomatitis and may complicate other types of ulceration such as diphtheria syphilis or carcinoma.

Since the original description by Vincent of these organisms in cases of hospital gangrene, they have been found in a variety of pathological conditions associated with putrid inflammatory ulceration. The commonest sites are around the gums tonsils and mucous membrane of the The lesions may be confused with diphtheritic syphilitic or carcinomatous ulcerations or the organisms may be pre ent as secondary invaders of these conditions From here extension may occur into the surrounding tissues causing extensive necrosis or into the middle ear larynx trachea and bronch; Less frequently any of the other mucous membranes may be involved-ocsophagus colon appendix and rectum The external genitals may be the site of fusospirochaetal ulcerations either as a primary infection or secondary to syphilitic or chancroidal lesions Deep phagedenic ulcers may result Post operative and other skin wounds may become infected. As pointed out above many cases of tropical ulcer fall into this category Finally the bronchi and lungs may be affected with the development of a putrid bronchitis or broncho pneumonia (particularly post-operative) which is often followed by abscess 1096 ETIOLOGY

esia and Lloyd Patterson has described an outbreak in Assam which swept like a plague through the country, seriously interfering with the efficiency of the labor forces in the tea plantations. Manson Baft state that it was very common a mong the carriers attached to the East African forces during the Great War and among them and in the native of Kenja it caused an immense amount of disability. During 1943 an epidemic was reported in the civilian population in Algeria from August-December 4 000 cases were reported. Many more cases were believed to have occurred. Amputation of the legs was necessary in at least 8 cases to save the hir co of pattents.

Biology —Although phagedenic ulceration is evidently an infectious condition its entology is not yet entirely clear. The most striking feature with reference to its cause is the presence of sprochaetes and fusiform bacilli in the lessons. These organisms are practically always associated during the active stage and the writer has found them not only upon the surface of the lessons but extending at times for at least several more centimeters into the tissuese surrounding the ulcers. James in a study of 892 cases states that all showed fusiform bacilli, while 75 per cent showed sprochaetes and 65 per cent intermediate filamentous forms.

Vincent (1896) in a study of 40 out of 47 cases cantured the used that spirochaetes and fusiform bacilli vere encountered in enormous numbers in the pseudomembrane of the teisions where other bacteria were only occasionally encountered. He also found

them later in a condition known as Vincent's angina

Rey sedits and Vaner who also found these organisms in tropical ulcar considered the sprind organ ms identical with Submission which Promagnet described in 1997 (8) non-xm of Suncerit Blanchard 1995). Webbach and Todd also encountered the sprochastes we until a sociated with fusions backlin in 90 in of 20 ulcters. While the sprochastes showed considerable variation in morpholory, there was one type which may present mill for the smears in great numbers.

While the fusiform bacills and spirochaetes are practically always found together it is not yet definitely decaded whether their association is a symbious or whether they represent different forms of the same organism. Some investigators Tunauchiff Smith (1938) James (1938) and others have observed an apparent transformation from one type into another in cultures. James emphasizes that sometimes preparations show every step between the funsform bacillus and the spirochaete via the presence of filamentous forms as though they all represented actually only one organism. These filamentous forms may be long and rather thack and may be seen dividing to form fusiform bacilli or they may be finer and show every gradation between a long straight form and a definite spirochaete. Some of the filamentous forms are exceedingly fine. However others believe that these two organisms represent distinct species. Both forms are obligate anaerobes and can be grown on enriched actificial media. Cultures have a fortid odor.

Tunnichif has cultivated the fusiform bocili anaerobically upon slants of asente fined ager at 37 5 C and observed that in such cultires before the fifth day only bacilit can be found but after this time spiral forms appear and finally constitute the majority of the organisms in the cultivar Slantet and Reddger (1933) and Spaulding (1937) have also cultivated

bers of spirochaetes identical morphologically with Spirochaeta vincents or S schaudinns and associated with the fusiform bacillus. In addition to these forms in some instances one finds cocci and other bacilli, but only very rarely cocci in such abundance as the spirochaetes and fusiform



Pig 36-S t noft p i lugh ng ph g d na Objetv AA Oul 6

bacili. A study of sections of the ulcers shows that the tissues at the surface have usually undergone a congulation necrosis. There is frequently a layer of coarsely meshed fibra in which large numbers of degenerating polymorphonuclear leucocytes spirochaetes and fusiform bacteria are present. Other bacili and occur are also seen in much smaller. 1008 PATHOLOGY

and gangrene. In these cases the organisms can be found in the sputum and their early recognition is imperative, since without appropriate therapy the mortality is high—40 per cent according to Kline and Berger These organisms are frequently found in pyortheal pockets and although they may have no direct causal relationship to the condition, they undoubtedly aggravate it. Such areas when neglected have been apily termed 'anaecobic incubators.' These organisms have often disappeared from the mouth after extraction of all the teeth.

Classification — The genus Fusobacterium is defined in Bergey's Manual (1939) as follows Gram negative anerobic rods usually with tapering

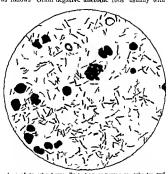


Fig 235-4 a of necrote t some flust ting numerous sp ocha tes and fur form baculli f om a trop at ulcer the active stape of which has shown in Fig 236

ends Usually non motile Stain with more or less distinct granules. The type species is Fusobacterium planti vincenti

D T Smith (1932) divided the fusiform bacilli into 3 types on the basis of their morphology. Type 1 is the characteristic large fusiform bacillus commonly seen in Vincent's angina. Type 2 is similar but thinner. Type 3 is smaller usually straight and is non-motile. This type was common in the pulmonary infections.

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A striking feature in the microscopical preparations made from the ulcers and examined either under the dark field microscope or in specimens hardened and stained with Giemsa's solution is the presence of large num

vibrios may also be concerned in some of the infections. He was unable to produce lesions with cultures of any of the organisms separately but only with mixtures of all of them He has also shown the identity of the organisms from oral and from pulmonary lesions. By intratracheal injection into rabbits he produced typical lung abscess or gangrene both with sputum from human cases and with membrane from cases of Vincent's angina

Endemiology —Infection in man is undoubtedly influenced by a num ber of circumstances Thus filth overcrowding and malnutration pre dispose to tropical ulcer which is probably frequently transmitted by direct contagion from man to man Patients suffering from other wounds and occupying beds under unbygienic conditions and next to cases with tropical ulcer are said not infrequently to contract it and evidence of the contagion is sometimes seen among school children who are in daily contact with one another Sometimes the prick or scratch with an infected instru ment may introduce the infection into the skin. A case of a nurse who had her arm accidentally scratched by an infected knife with which a tropical ulcer had been excised two hours before is of interest in this connection Although the wound was immediately washed with a solution of lysol 3 papule later appeared which rapidly broke down into a typical ulcer

Apostolides performed an artificial inoculation through the broken skin in two cases. In both of these cases Spirothaeta schaudinms and Bacillus fusiforms were obtained in the lesions. In one the lesions apparently began 48 hours after the direct inoculation Pampana mocu lated pus taken a few minutes before from a tropical ulcer very rich in spirochaetes and fusiform bacilli into another patient suffering from a lacerated and bruised wound of the ankle which was shown to be free of spirochaetes or fusiform bacilly by repeated examination. The wound was dressed aseptically afterwards and for about a week no change was noticed Twenty nine days after the moculation a typical tropical ulcer developed in the place of the former wound and the first smear made from it showed numerous spirochaetes and fusiform bacilly. The ulcer healed subsequently under appropriate treatment

Patterson has reported that by bandaging a swab smeared with the ecretions from a typical sore on the surface of an abrasion on the skin from which the scab had been removed he succeeded in producing a characteristic sore

James (1938) believes that he has demonstrated that the discharges from a phagedenic ulcer are actively infective and may transmit the infection to another part of the body by direct inoculation from the original lesion

It has been observed that the disease in some localities attacks especially the undernourished and malaria stricken natives. Clements in Melanesia and James in the Solomon Islands believed that diet defi ciencies especially in vitamin B2 as well as climatic factors and malaria predispose to the infection Nevertheless they consider that the fusiform spirochaetes play an important part in tissue destruction

numbers In films from a number of our cases of ulcer, phagocytoss of red cells by Poly morphonuclear leucocytes had taken pide. The epi thelium surrounding the ulcers frequently shows thickening and downward growths, as is so often observed in other chronic ulcerative processes. Acantholysis is sometimes striking. The epithelium is often markedy infiltrated with polymorphonuclear leucocytes. The corrum may be odematious and infiltrated with polymorphonuclear leucocytes and with lymphoid and plasma cells while the subpapillary layer often contains many, fibroblasts. The walls and bases of the ulcerations consist of granulation tissue the deeper tissues as well as the corrum show a marked infiltration with lymphoid and plasma cells. Vertical sections of the ulcers reveal a large amount of granular detrities and numerous foci of leucocytic infiltration while the deeper layer consists of more dense fibrous tissue. Sprochaetes and fusiform hacilli and not infrequently other bacilli are found, particularly in the areas where definite necrosis of the tissue has occurred. The 232 fullstrates the enormous numbers in which the spirochaetes and fusiform bacilli are founded in the spirochaetes and fusiform bacilli are founded in almost pure culture.

Method of Infection -Although the fusospirochaetes are found so commonly in the ulcerative lesions it is not yet entirely clear whether they are the sole primary etiological agent or whether they are merely present as secondary invaders which modify and extend the lesions The disease is not readily communicable to the lower animals by direct inocu lation The writer attempted to produce lesions in monkeys by removing small pieces of tissue from the ulcers and after they had been thoroughly rinsed in normal saline solution granding them up in a mortar suspending in saline solution and the suspension injected subcutaneously into the animals Suppurating and ulcerative lesions were produced in some of the e animals in which both spirochaetes and fusiform bacilli as well as cocci were found present. However such lesions were only produced in those animals in which the skin had first been bruised or otherwise injured at the point of inoculation From our observations and those made by other investigators it seems probable that the organism cannot usually establish itself in healthy skin or even in many asentic wounds and that it is only when the integument is bruised burned or otherwise injured and the circulation interfered with or the vitality of the tissues otherwise impaired that necrosis occurs and that phagedenic ulceration results

More recently Kritchevsky and Seguin have stated they helieve the organism to be primary and they have produced local abscesses mammals and occasionally a generalized spirochaetosis by the injection of pure cultures of spirochaetes and fusiform bacilli. When either alone were inspected no lessons were produced. The invision of progenic occit was believed to be a secondary phenomenon. E. Smith (1936) has also produced typical tropical ulcers in hedgebogs by intraculaneous and sub-cultaneous inoculations of material from human ulcers. Both fusiform and spirochaetal forms were found in the experimental ulcers. He believes that other anacrobic organisms especially streptococci and

and depth through the slan and subcutaneous tissues and if untreated a leismo anywhere from 5-10 cm in diameter may result. The margin of these ulcerations are not generally undermined or raised to a striking extent. The base of the ulcer comes to consist of sloughing tissue and portions of this tissue are gradually cast off. The surface is often bathed with purulent material assuming a gray or greenish gray appearance. On wiping away this crudiet a reaso of granulation tissue may be seen spring ing up in different portions of the base of the ulcer or near the margins. In the course of a week or two the sloughing process may case. In other instances the slough extends in depth and in some instances will destroy not only the superficial fascia but in some instances muscles tendors nerves and vessels and even the periosteum of the bone may become necrosed by the gargrenous process.

In such cases in which the joints hones and large blood vessels are destroyed even if the patient recovers great deformity may result from the contracting cicattries or from ankylous. James reports that in New Britain ulcers and other complications (toxacmia deep sepsis and exhaus ton) were the chief causes of deaths in the hospitals. To save life urgent amputations were often necessary though amputation proceed risk; because of extensive subcutaineous extension of the phagedenic process. In severe cases the formation of scar tissue is unfavorable for the prognosis sace it dimmisses the blood supply in the new skin and even after healing the lessons frequently break down.

DIAGNOSIS

Laboratory diagno is of fusospirochaetosis depends upon the demon stration of the organisms in staned smears or by dark field illumination in perfectly fresh material. If any membrane is visible in the lessions it should be removed and preparations made from the depths of the ulcer. In regard to pulmonary disturbances the fact that the organisms are present in small numbers in the mouths of many normal individuals must be remembered in interpreting the findings and other pathological conditions to which they may be secondary should be excluded. Sputum must be examined when fresh since the sponochaets may be autolyzed within an hour or two. The peculiar sickening slightly sweetish odor to the breath in infections of the mouth and lungs may suggest the eulogy. There is no increase in the granular leucocytes in the blood and there is occasionally a marked lymphocytesis.

TREATMENT

Very satisfactory results in treatment have frequently been obtained with neosalvarsan or neoarsphenamine employed both locally and by injections. For local application of the ulcerations a 3 per cent solution of salvarsan or arsphenamine may be applied on a piece of cotton for 24 hours at a time. When healthy granulations appear then mild antiseptic ontinents such as those containing bone and have been recommended Corpus has treated 398 cases of chronic ulceration in the Philippines in 1102 SYMPTOMS

McCulloch reports the blood calcium content blood sugar and blood area to be much diminished probably as the re-ult of deficient dictary

Gokhole in the examination of a goo recrusts points out the absence of trop all uter in the Sandrie tribe. Tangany has territory. Their diet consisted of meat m'v cassava sweet potato and dired fish which should give a high blood calcium. He thinks this an explanation of their freedom. Since they do not est vegetables the majority of the calcium in their direct due to not reduced by the pre-sence of oxylate. In

other tribes in the same district, this diet low in calcium ulceration, are very common Charters found tropical ulcer confined to two Somali battalions whose food differed from that of the East Africans. The main dissimilarity between the two diets was a

deficiency of vitamin A and riboflavin in that of the Somalis

As the feet and legs are most exposed to injury they are the most frequent locations of the form of uterration. Nevertheless the arms or other parts of the bo by may some times be attacked. Since cracks and abrasaons of the feet are common among the



Fir 237-Tropi alul r act a st ge Amazon a

prophe who go tarefood d it has been suggested that native and Luropeans might become underted from bruses when vading in attigant or other vater in the troopic factor. Picha and Lena behive polluted water to be the cau e of the infection and Smits has held the poisoned that human earth in plantation draws carries the organism. However, the properties of the properties

Symptoms

If a lesion begins independently of any abrasion or trauma of the skin the ulceration may be preceded by the formation of a vesicle. It so on unturns leaving a sloughing surface. In other instances a small papule may be first noticed, which soon becomes inflamed and ulcerates. Devel opment of the les on may be associated with pain some fever and constitutional disturbances. The ulceration extends rapidly in diameter.

and depth through the skin and subcutaneous tissues and if untreated a lesion anywher from 5-10 cm in diameter may result. The margin of these ulcerations are not generally undermined or raised to a stirking evitent. The base of the ulcer comes to consist of alonghing tissue and portions of this tissue are gradually cast off. The surface is often bathed with purulent material assuming a gray or greenish gray appearance. On wiping away this evidate a reaso of granulation tissue may be seen spring ing up in different portions of the base of the ulcer or n at the margins. In the course of a week, or two the sloughing process may case. In other instances the slough extends in depth and in some instances will destroy not only the superficial fascia but in some instances muscles tendons nerves and vessels and even the periosteum of the bone may become necrosed by the gangrenous process.

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DIAGNOSIS

Laboratory diagnosis of insesprochaetosis depends upon the demonstration of the organisms in stande shears or by dark field illumination in perfectly fresh material. If any membrane is visible in the lesions it should be removed and preparations made from the depths of the ulcer In regard to polimonary disturbances the fact that the organisms are the remembered in interpreting the findings and other pathological conditions to which they may be secondary should be excluded. Sputum must be examined when fresh since the spurochaetis may be autolyzed within an hour or two. The peculiar sickening slightly sweetish odor to the breath in infections of the mouth and lungs may suggest the etiology. There is no increase in the granular leucocytes in the blood and there is occasionally a marked lymphocy toss.

TREATMENT

Very satisfactory results in treatment have frequently been obtained with neosal-arsan or neoarsphenamine employed both locally and by injections. For local application of the ulcerations a 3 per cent solution of salvarsan or araphenamine may be applied on a piece of cotton for 24 hours at a time. When healthy granulations appear then mild antiseptic untiments such as those containing horic and have been recommended Corpus has treated 598 cases of chronic ulceration in the Philippines in

1104 TREATMENT

which 4ro patients were cured He found this a most effective method of treatment which Corpus has found very satisfactory consisted of bathing the ulcer with a r-4000 solution of potassium permanganate and then dusting with Vincent's powder (I part of sodium hypochlorite with 9 parts of born card)

Schussner, Werner and Smits have also reported particularly favorable results in the treatment of tropical ulcer by injections with salvarsan. In fact, many cases which would not yield to surgical treatment and which

only became worse were cured by the use of this drug

Tournier has also found that the subcutaneous single injection of 0 accentigrams of novarsenobenzol in 4 per cent sodium chloride solution is a most catisfactory method of treatment. He found this type of ulceration to be uninfluenced by atoys or antimon.



Fig 238 -T op cal slough ng phagedena advanced stage Amazon a

In cases with pulmonary lesions neosalvarsan or arsphenamine should be given intravenously as soon as the diagnosis is made

Pampana has recommended particularly for the ulcers duly dressings of r-roco solution of acriflarine. He obtained excellent results, and after the fifth day of treatment bacilli and spirochaetes were very rare in the lesion and the ulcers soon showed good granulations and healed in a short time after an excellent particular and the solution of the particular and the solution of t

Several authors have recommended surgical treatment and the scraping analy of all the sloughs and softened tissue with a Volkmann spoon until a firm base of sound tissue has been obtained and the undertinede dages of the skin cut away with scissors so as to leave no pockets. Such method of treatment however is very painful and is usually unnecessary. Excusion with subsequent skin grafting may be recommended in suitable cases.

Van Nitsen and Walravens succeeded in obtaining cultures of the fusiform bacillus which was a strict anaerobe on ascrite fluid covered with a layer of sterile paraffin. The growth contained an abundance of the associated bacteria the fusiform bacillus and the spirillum. Suspensions

of the associated bacteria were sterilized and a vaccine prepared. Doses of one fourth to one half three fourths and one cubic centimeter were given at intervals of two days. Some 200 patients were treated in this way but the authors found no improvement with the treatment and pronounced it of no curative value

More recently Pons has carried out vaccino therapy in tropical ulcer and found that the anti spirilla vaccine had a rapid action on the phage denic ulcer in all cases treated Forty-eight hours after treatment was begun all pain had ceased and the inflammation had disappeared After 3 days there was no sign of necrosis and after the fourth day cicatrization commenced Complete cure of the ulcer was sometimes long depending particularly on the general condition of the patient and the character of the lesson Four to five injections were usually enough Pons states that the organism isolated from the ulcers and used as an antigen differs some what from Spirochaeta tincents in its dimensions and cultural properties but he could not state whether or not antigenic properties existed which

were common to both yerms

Pfannenstill has recommended the use of sodium iodide combined with hydrogen peroxide In the case of an ulcer on the surface of the body or the limbs he recommends sodium rodide in the average dose of 15 grs two or three times a day Larger doses 60 grs to 90 grs a day may be given but entail some risk of jodism Immediately after the first dose of the salt the local treatment with perovide is commenced. The ulcer is covered by a layer of cotton wool which is kept constantly soaked with the acidified perovide solution which is dropped upon it every tenth or fifteenth minute or if desired more frequently. The strength of the peroxide solution should be 1 to 3 per cent to which there should be added 14 to 14 per cent of acetic acid Pfangenstill believes that the sodium todide after being quickly absorbed into the blood is carried to the ulcer ated site. Here it meets the hydrogen perovide the rodine is set free and being in the nascent state acts purely as a hactericide the iodine being more readily freed and to a greater extent if the hydrogen perovide is in acid solution The blood contains most sodium todide about one to two hours after its administration so that this is the time when particular attention should be paid to soaking the wool with the perovide solution This method of treatment however is obviously not very practical in

many tropical countries where tropical ulcer abounds Amaral has reported exceedingly successful results in Brazil by means of the local application of normal dried serum without the use of any antiseptic substance. He states that on the first application of the serum the ulcers begin to change in appearance becoming clean and regular and when the dressings are applied with care some of them become aseptic An intense reaction of ciratrization is produced without delay and the sore begins at once to heal A complete destruction of the spirochaetes and fusiform organisms occurs daily Amaral considers this superior to all other methods of treatment Various hismuth salts have been used both for local application and injection (Field 1940)

rioó treatment

Houssau has reported recently a case of three and one half months duration which was previously treated with local caustics and necessivarian injections without result. The ulcer, however, almost completely healed after 3 intramuscular injections on successive days of 3 cc succinate of bismuth, followed by a further injections at 2 and 3 days interval. Local applications of bismuth hydroride in oily suspension were employed concurrently

Injections of antimony tartrate have usually not given particularly satisfactory results. Abraham however claims to have obtained sitts factory results with this drug in the treatment of Naga sore in the tea gardens in India. Abraham however states that these ulcers were of undetermined etology, so that possibly they might not be correctly class.

fied as phagedenic ulcer

Generally speaking, the treatment with the organic arsenical compounds appears to be the most favorable one, with daily anuseptic cleansing and dressing of the lesson and later strapping with elastoplast Terdschanian has reported an excellent result in a case of 2 years standing from injections of neosalvarsan and local treatment of 10 per cent copper subshate solution

James (1938) has also employed copper sulphate in glycenn using as much as the glycenn will absorb. To each ounce of the resulting solution he adds one dram of pure carbolic acid as an anesthetic. This solution is applied daily to bad ulcers until the surface feels hard and granular. In the early stages small superficial ulcers after cleansing often heal by Morson's method with bismuch boddrom paste aided by firm strapping with elastoplast. For larger ulcers, James believes in excision and immediate skin grafting

Kerby advises that rinc ionization is valuable in stimulating the healing of chronic ideas. For this purpose he advocates a 1 per cent solution of zinc sulphate at the rate of a map per square inch for 20–20 minutes. Many other methods of treatment have been recommended. Velupillary (1941) has reported especially successful results with the application of shark her of which he points out has a very, high vitamin A content

to which the healing of the ulcers is attributed

Good results were reported by Bayley in 1939 from sulfanlamde therapy. However Manson Bahr (1939) reported two cases in which it had no effect Earle (1930) in a more extensive trial of sulfanlamide, found it was of doubtful value in the long standing ulcers but that it seemed to be of value in recent ulcerations and in the pre ulcerative or vesicular stage. In the cases favorably influenced local treatment was also employed with other drugs.

It has been suggested that saturated solutions of sulfanilamide (e.8) in normal saline solution might be employed locally for treatment Herrell and Brown (1940) have reported encouraging results with it in the treatment of badly infected womeds. While the precess mechanism of the chemo therapeutic action of sulfanilamide on hactern is not entirely clear the action of the drug in the wound may be modified by several factors. Destruction of tissue resulfs in a hreakdown of protein with the formation of peptone and the presence of peptone inhibits the hetero static action of sulfanilamide. The destruction of tissue in tropical uleer

VELD SORE 1107

is usually extensive hence the drug will probably be of no value except in very early lessons. Sulfathancole has also been recommended for local user Lages (1941) has reported that sulfandamide is of value in epidemic tropical ulcer provided it is applied locally and given by the mouth as well. He believes it is the combination of the two methods that is probably responsible for the favorable action.

In undernourished and cachectic individuals attention to the diet is of importance and a well balanced thet including fresh vegetables and lime juice should be provided. In cases in which there is evidence of malarial

infection quinine of course is indicated

Treatment recently suggested as the pre-cut war meduces the following. A bulleting from The War Office London Ap 1 ag pre-minued as That the ulcer 1 completely exposed te all out that get as each cheeds to damm up di charges is removed a The wound is stabled in hype from remagnessing subjusts colorion probably isotomic solict in re equally efficat ons 3 Sufficianmed powder from crusheds sufficiantly in the stables in applied to the ulcer. Generally, ab it one third of a table is required to a 2 gr at Zinc ide plaster is applied for thy too the ulcert covertit. 5 The wound is not dressed again for about 3 days. The advantace schained are tast healing takes place in 7-10 days. Much time and material (gauze inst wo 1 et cetters) are saved. D a many is little interferred with and adays son to hopytats 1 often av ded

D a mig a little interferred with and admission to hosyital; often av ded G ndlay (total) state that following the execution from B in ma in 1942 many cases of naga soc n Chinese Indian and North B ma ti hi spe pl we e dessed daily by his ho pit unt. For textement he ce mem ded Immade the c. n fail daily by his hop that in the streament he ce mem ded Immade the c. n fail daily by the streament has been med defined to the streament has been ded to the stream and the streament has been dessed by the streament has been dessed by the streament has been dealered by oller bandages. When give is n tava, lable as to acted acqueou is lut on f mag neum unblaste directions should be held truly in place by oller bandages. When give is n tava, lable as to acted acqueou is lut on f mag neum sun sulphate may be used and the dress mps cased in this has fit eq ent inter whis Cocas onally in the infected where in nait es magnet were encountered. In such nataceable emirates the tirt is fare of that all have note be nermoved the wound should be packed with quate souked in accordance and in the city of one day. As schloramid seems superior to magnetism subplate glyce in in this one respect. Sailto me described the substance of the member of the substance of the magnetism subdet may be supposed tisses and the out dispatched posteler created laws abbed mine all suproceed tisses and the out dispatched cotton is related to the substance of the member of the substance of the counter of the substance of the counter of the substance of th

Vetn Sore

Synonyms -Desert sore Barco rot

A for mel tropical ulcer has been described under the name of seld sore which is common in varia nod sert regions. It is forequest in north Austrian and Quee had and affected the British to ope in the Sudan and South African campaigns. It all o was reported to have caused a considerable amount of deskubity to Gall job. Egypt Pales the and Ir q during the geat var. In South African it has been observed especially maps tomor and off ters.

These ulcerations may appear on the face as well as on the dorsal surfaces of the hands or forarms or on the lower extremities. They seem to arise from infections of abrasions of the exposed parts. In the early stages of the lesson the diphthera bacillus has been frequently isolated and some of the cases have been followed by diphtheritie palsies. The lesions have at times been demonstrated to constitute a form of cutaneous diphtheria. Such cases were reported by Craig in the Sinai desert. The simultaneous existence of cases of ordnary faucual diphtheria should

make one suspicious of the real nature of such ulcerations. A diphtheritic ulceration of the skin may be more frequent than was formerly supposed

However the klebs Loeffler bacillus can be isolated with ease only from the primary lessons. In the chrome ulcerations it is very difficult to recover it, as it is often overgrown by staphylococci and other suppurating organisms.*

Biggam (1942) also has observed that anal diphtheria is a more serious affection in its initial appearance it may resemble a thrombosed haemorrhoid. The condition may be a definite hazard among troops in the desert.

The veld sore starts as a vesuele, which soon breaks down to form an erosion which tends to spread. The pain is more marked than would be expected. In about 2 or 3 weeks a punched out ulcer may result, which is covered with a dirty gray deposit—not distinctly membranous in clar acter. The ulcer is very chronic and resists treatment with the usual applications but following injection of antidiphtheritic serum in the subcutaneous tissues near the sores there is often rather prompt response.

Scott saw numerous cases in the British troops in the World War Manson Bahr states that the desert sores he observed among British troops occurred

Manson Bahr states that the desert sores he observed among British troops occurred most frequently in men of mounted units and the rate of incidence coincided with that of a wide spread epidemic of faucial diphtheria.

SYMPTOMATOLOGY

These ulcers are most frequently found on the dorsum of the foot over the shin and about the external malleolus. More rarely, they involve the dorsum of the hand or back of the wrist and occasionally, the face In the multiplicity of clinical descriptions from various parts of the tropies two types of well developed ulceration, have been especially noted

One is that of a rather chronic ulcer, which slowly develops from a painless awilling which is not unlike a gummatous process. Surrounding the swelling is a circumscribed reddened glazed area of skin. After two or three weeks the swelling begins to solten and a serous fluid exuder from its summit. Ulceration with the frequent formation of a membrane like deposit now sets in and later on their ersults a more or less punched out ulcer showing indurated margins. There may be no impairment in the health of those with this type of ulcer.

The other type is generally seen in persons who are much debiltated or suffering from some cachectic state. In the earliest stages these sores seem to resemble an area which has been excorated and inoculated with vaccine virus there being a rather dry angly looking spot of crythema. This within a few hours may be surrounded by circle of vesicles beyond which is an enerching inflammatory areola.

There is marked subjective pain and tenderness. The serum from the vesicles at this stage may show few if any bacteria and the cellular contents are made up almost entirely of polymorphonuclear leucocytes.

Biggin has also noted the occurrence of a second form of desert sore which is attributed to a haemolytic streptococcus. Some observers believe that this is the more common form encountered in the desert

Within a few hours to one or two days the area within the ring of vesicles is converted into a dark gray to black pultaceous diphtheroid membrane which when detached shows underlying lungating granulations covered with greenish yellow piss. This membrane if stripped off tends to reform with great rapidity (twenty four to forty-eigh hours) and in many respects resembles the membrane of diphtheria except for its dark color These ulcerations extend with great rapidity and even when showing a tendency to heal may suddenly from a point along the margin proceed to form a new area of ulceration extending somewhat as would a ringworm When the original site of ulceration fails to heal during a period of several weeks the edges become rather indurated but do not show the punched out or undermined characteristics of the first type. These cases last for months and are far more tantalizing than the former type of ulceration for the reason that from time to time they show a strong tendency to beal the process clearing up almost entirely when suddenly the former area of the ulceration is oqualled or exceeded

Whether all these ulcerations are primarily diphtheroid in origin is not clear. However, typical diphtheritie parsess or paralyses occurred as complications in 27 per cent of one series of cases. Paralysis of the palate arms and legs and accommodation and paralysis of the iris have been noted. In other cases atava, loss of knee jerks anaeathesia and uncoordination have been observed.

TREATMENT

Specific treatment recommended is anti-diphtheratic serum at least soo units being injected subcutaneously in the vicinity of the sore. The sores should also be dressed at first with the same serum or with weak disinfectants. Preparations of chlorinated lime and bonc acid have been frequently recommended. A popular antiseptic used during the World War for local treatment was eusol which was made by shaking up 1. 5 grams of bleaching pender in a biter of water then adding 12.5 grams of bone acid. After shaking again and allowing the mixture to stand a few hours it was filtered the clear solution being eusol. It should be kept in well stoppered bottles or made fresh from day to day.

Many reports have been made regarding the prevalence of desert sore in the British troops in North Africa during the present World War. In these reports the bacteria conountered base usually been the pyogenet cocci and not the diphtheria bacillus. Rapport (1942) after treating roop patients points out that the skin is far more susceptible to injury in the climate of the desert and the condition is almost universal among troops there. New comers among the fair skinned men being specially susceptible. The minimum amount of trauma results unfavorably in a breach of the skin surface and a desert sore frequently results. Bites due to files bugs and mosquitoes occasionally supperate and give rise to a sore. He believed prophylactic treatment should be primarily the provision of a diet comprehensive in essential material constituents especially vistamin C. In the Army ascorbic acid tablets (25 mg.)

I tablet per man daily were administered and the covering of all cuts and abrasions so as to prevent the access of flies and sand. He found the following remedy generally effective powdered sulfapyridine incorporated into paraffin molle flav (3 5 gr tablets of sulfapy ridine to 2 oz of paraffin molle flax) This is applied locally and the dressing renewed after 1 days

In cases in which the diphtheria bacillus has been found in the wound in addition to serum treatment it has been stated that C diphtheriae is Penicilin susceptible and it is suggested that the local therapy by con tinuous application of a solution containing 250 units to the cubic centimeter applied at the site might be of special value

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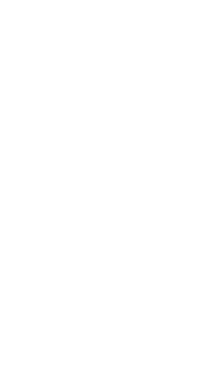
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Chapter XXXVIII

GRANULOMA VENEREUM

Synonyms -- Ulcerating granuloma of the pudenda granuloma inguinale

Definition -An infective ulcerating granulomatous condition gen erally involving the pudenda and adjacent tissues and conveyed usually by sexual contact. In most cases there is no tendency towards spon taneous healing

Geographical Distribution -According to Daniels the disease was first described by Macleod in India under the designation Serpiginous ulcer ation of the genitals In 1896 Daniels and Convers described it as a very painful disfiguring and contagious disease occurring in both men and women in British Guiana Since this time it has been reported by many investigators in most tropical countries and is today widely prevalent in parts of India Guiana Brazil (especially Amazonia) the West Indies Puerto Rico the Pacific Islands and northern Australia It is also com mon in southern China In Africa, it has been reported on the West Coast and in the north and central districts. Numbers of cases have been observed in the southern Umted States in negroes and it is not uncommon among the negro population in New Orleans DeVogel has reported that in some areas in the southern portion of Dutch New Guinea the disease occurs in epidemic form and has threatened the extinction of some of the local tribes. With reference to its distribution in India Chopra (1936) has found that it is largely confined to the eastern side of the peninsula However while it is common in the hospitals in Madras on the other hand it is rarely seen in the large skin outpatient department in the Calcutta School of Tropical Medicine

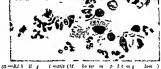
ETIOLOGY

Donovan (1905) described short rod or oval organisms as the causative factor * They were found in all parts of the ulcers but were particularly abundant in the deep portions where no other organisms were present They were subsequently termed Donovan bodies and were first believed to be a species of Proto ou By some they are regarded as bacterial in nature and are encountered in large numbers in large mononuclear cells present in the lesions A number of investigators still regard the etiology of the disease as undetermined Nevertheless the presence of these organisms is such a constant occurrence in the typical ulcerative lesions that one is not justified in making a diagnosis of the infection unless they are present

Naming it Calymmatobacterium g anulomatis

Flu in Surinam and Vianna and Aragao in Brazil also observed similar organisms within the large mononuclear cells from scrapings of the lesions They reported the cultivation of the organism and noted its resemblance to Friedlander's bacillus Walker in 1018 also cultivated on Sabouraud's and other bacteriological media a bacillus that he believed as had Flu to belong to the group of so called capsulated bacilli of which Bacillus mucosus cabsulatus Friedlander was the type

A number of cases have been studied in the United States from an etiological standpoint. In most of these cases the encapsulated organism has been found in the mononuclear cells However in a number of them in which this organism has been present attempts at cultivation have failed and this has led some investigators to believe it doubtful that it represents a strain of the Bacillus mucosus capsulatus which is readily cultivable on general hacteriological media. Thus Johns who studied 04 cases in the Charity Hospital in New Orleans was unable to cultivate it from any of his cases He points out that while Bacillus mucosus



tom) Trop cal Inttut L dn (After Plu)

capsulatus is pathogenic for laboratory animals the Donovan bodies were absolutely non pathogenic for them as proved by injection of scrapings and tissue fragments and other implants from the human lesions

Similar organisms have been found in the lesions of the condition known as rhinoscleroma and this bacillus has been termed B thino scleromatis being first described by B Frisch in 188 This organism however is apparently much easier to cultivate on ordinary bacteriological media than the organism of Granuloma venereum. Sniiders in Sumatra thought that there might be close association between these two diseases

McIntosh reported that he was successful in transmitting granuloma venereum from one individual to another and that he constantly found the presence of Donovan bodies in the experimental lesions Campbell however contested this work of McIntosh arguing that in the trans planted tissues other organisms might have been present. He was unable to transmit the disease by moculating himself and other individuals and laboratory animals with cultures of the organisms he obtained from the lesions Although Donovaus organisms are almost constantly present some have suggested they may exert a symbiotic influence with the primary cause and represent a secondary invasion F L Meleney and

1112 SYMPTOMS

several others have emphasized the importance of a non-baemolytic streptococcus in the production of the lesions *

SYMPTOMS

The infection is usually limited to the genital regions A few cases have been reported in which the mouth was involved and the process invaded the face and neck. Torres reported an instance in which the disease subsequently attacked the upper lip and nose Sidlick also noted ulcerations in the mouth of a typical case in which the disease started on the penis and then spread to the groins and right cheek Lynch reported its occurrence on the hack and on the legs The disease has not been recorded as occurring before puberty It occurs in hoth sexes, but more often in women and this has been said to be the case especially where polyandry is practiced



Pig 240 - Ulcerat ng granuloms of the pud nda

The incubation period is often short from 2 to 8 days after sexual contact. In other instances the lesions have not been noticed until after 2 or 3 months following sexual intercourse. The primary lesion begins in the male usually on the penis in the female on the labia minora and consists of a small vesicle papule or nodule which gradually extends over the skin and mucous membranes new papules and nodules forming at the margins in the bealthy skin. As the process extends the thin epidermal layer may rub off leaving an excorated surface consisting of granulations that bleed easily and give off a creamy discharge frequently very offensive Suppurative ulceration usually occurs later

The process extends from the penis to the groins by continuity and thence down the inner surfaces of the thigh. When the glans penis is involved there may be a fungating growth suggestive of epithelioma. In the female, the infection extends from the labia minora into the vagina and also to the labia majora and thence to the perineum and peri anal region Recto vaginal fistulae often result. The process extends more rapidly and markedly when invading mucous membranes

More convincing experiments have been performed by Greenblatt Dienst Pund and Tropin (1939) who have transmitted the disease to 3 volunteers by direct mocula tion of fluid containing Donovan's bod es and have shown that it is doubtful if the organism has been cultivated

When the granulomatous process is advancing there is frequently containation of the areas previously invaded forming a scar tissue which breals down easily. There is little pain or itching and the general health is not impaired. There is no enlargement of the lymphatic glands in the uncomplicated cases. Although the process extends by continuity yet it may also pass to parts not in contact with the diseased area and at times by auto inoculation. While healing of affected skin tends to occur that of mucous membrane does not. There is usually very little tendency to deep ulceration.

The extension of the process is very slow when invading skin surfaces and there may be a history of years involved in the production of a large patch of scar tissue. At times spots of active granulations may show on



an area of glazed unhealthy looking scar tissue. An abundant serous discharge which has a very offensive odor frequently occurs from the excorated patches of hin

In neither sex do the lymphatic glands become affected unless secondary infection occurs with streptococt or staphylococt. The infection remains a local one Eventually large creatricial lesions are formed These however in untreated cases usually do not represent a healing stage as the infection still shows a tendency to spread. In some instances hypertrophic lesions result from an extensive fibrous reaction in the subcutaneous tissues in which however four of active involvement continues due to the persistence of the infective organism. As a result of creatriza tion the lymph channels are sometimes blocked and pseudo elephantisus of the genetalia may occur. Manson Bahr reports that impassable strictures of the urethar may result and recto vagunal fistulae. In such cases death may result from extension of the infection into the bladder resulting in sentic cystisis.

PATHOLOGY

The histological appearance of the lesions varies considerably. Usu ally the connective tissue of the corium swells and disappears and in its place one finds an extensive round cell infiltration which is often par ticularly diffuse in the central portions of the lesion The diffuse cellular inhitration which is observed surrounding and below the central area is composed of polymorphonuclear leucocytes lymphoid cells endothelial leucocy tes and a few plasma and mast cells Particularly at the pemphery there are connective tissue cells In areas of typical granulation tissue numerous capillaries are observed, but there are no haemorrhages Giant cells are usually not found Near the margin of the lesions polymorpho nuclear leucocytes are usually abundant being found particularly in the papillary layer of the corium In the reticular stratum the polymorpho nuclear leucocytes are usually in small numbers, endothelial leucocytes predominating with a smaller number of lymphoid cells and plasma cells The cells of the epidermis are swollen often hyaline and show mitosis The papillae are usually found to be increased in length and in some instances penetrate downward into the papillary and reticular stratum In the older lesions there is no caseation, but the tissue becomes oedematous and many fibroblasts and later much cicatricial connective tissue is found

The most characteristic picture is the presence of numerous smollen mononuclear cells (endothelial phagocy ies) containing large numbers of encapsulated rods (Donovan's organisms). Many of these cells are vacuo lated and the organisms he in the vacuoles. In some instances the cells present a foamy like appearance. These cells have been described by

Pund and Greenhlatt (1938) as typical granuloma cells

In the hypertrophic Essons there is an extensive fibrous reaction in the subcutaneous tissue in which however small areas of active inflammation in which endothelial cells containing the organism are visible. In the exastricial lesions. Von Haam (1940) describes the characteristic changes as consisting of thick bundles of collaginous fibrous tissue including still small foct of inflammatory reaction, the collaginous tissue resembling closely the keloid masses often observed in the scars of nigroes.

Gage suggests that owing to the abundant transformation of new connective tissue which constitutes one of the most important features of the lessons that the term sclerosing granuloma is more appropriate than ulcerating as the ulcration seems to be insignificant in compination with the formation of the dense fibrous tissue and deep scarring. In one case he observed that epithelial cells had become completely separated from the branching papillae of the epidermis and in one area he found pear formations of these separated epithelial cells the condition resembling a spino cellular carcinoma.

DIAGNOSIS

The diagnosis may be made by the demonstration of the characteristic organisms Scrapings should be made from the ulcerations or other lesions

and stanned with Giemsa or Wrights stain. The organism are encapsulated and occur as either oral or diplorecool in form or as vers short rods measuring about 1:5 b; 2µ. They are Gram negative. Usually they are enclosed in large mononuclear cells but sometimes they may be found free in the preparation.

Pund and Greenblatt have employed salver stains for their demon stration By silver impregnation methods they appear as dark brown



Fig 4 - V nere I granul ma (Afte M rs)

or black elongated ownd masses with intense bipolar staining. These organisms have been found in sinears stained by Geimas's solution in from 60 to 80 per cut of the cases. They are usually present in the active stages but in the true healing scars they are sometimes no longer present or demoustrable. Von Haam (1940) has found them in every one of his cases in the active stages of the disease.

Climically the disease must be distinguished from syphilitic ulcerations of the groin. The absence of general gland involvement and of secondary

manifestations of syphilis and the failure of antisyphilis. In the liboratory it may be distinguishing the disease from syphilis. In the liboratory it may be distinguished from this disease by the presence of Donovan organ isms and by the absence of the Wassermann reaction. In some respects it resembles lupus vulgaris, but it is not associated with the tuberde bacillus and there is an absence of guant cells and of tubercles and of caseattion in the lessons.

Generally there should be no confusion with malignant disease. However, Pund and Greenblatt have reported upon a fungating form affecting the cerviv in negresses which may resemble the ulcerative and vegetative type of carcinoma of the cerviv. Its eventree chromety and the absence of carchiva do not suggest a malignant nature in most cases.

TREATMENT

Intravenous injections of tariar emetic were first employed in the treatment of granuloma inguinale in 1913 in Brazil by Arago Visina and de Souza Araugo This work was soon confirmed by Breinl and Priestly in the treatment of a case in Australia. The value of the drug in the treatment of this affection would appear to be undoubted It is also recommended to apply locally compresses soaked with ½ per cent of tartar emetic. Some observers recommend the application of an ointment containing r per cent tartar emetic left on for a hours and then wiped off and boric acid ointment applied. Intermittent cleaning with eusol solution is advisable. Touching of evuberant granulations with silver nitrate sometimes promotes healing. Among more recent authors who have considered and emphasized the efficacy of antimony in the treatment of the disease are Randall Small and Bell. Gage, Can opius, Schochet, Murdock Chopra (1936). Manson Bahr (1910) and others.

DeVogel in the treatment of 572 cases in Dutch Guiana, reported that 86 i per cent were cured after one series of injections and 128 per cent after a second series. While the total amount of antimony necessary for a complete cure varies from case to case it has been roughly estimated between 17 and 18 gr. However some advanced cases have required 170 gr to complete the cure. In the majority of cases it is well to begin with a dose of 2 cc. of a 1 per cent solution gradually increasing the dosage to 5-10 cc. at daily intervals.

Kandall recommended intravenous injections of trainide of antimony, though collect and in 0.4 per cent solution, or sodium antimony thiogh collect in 0.5 to 1 per cent solution. Then cases were successfully treated.

Occasionally however cases do not yield to antimony treatment

Earle (1938) points out as a possible cause of antimony resistance that where the oederna fluid is rich in albumin the absorption of certain of the antimony compounds may be bindered so that the causative organisms of granuloma venereum are not reached at all 1 in 5 cases of the disease in which 4 were resistant to autimony treatment the patients had apparently bad previous lymphogranuloma inguinale infection and oedems of the infected areas.

In certain instances in which secondary infection with nonhaemolytic anaerobic streptococcal infections have occurred as reported by Meleney he has recommended treatment with the standard preparations of zinc periodic the active preparation being rubbed into the wound mixed with distilled water to give a consistency of 40 per cent cream. Also for the treatment of such cases sulfandamule therapy has been recommended and Ross has recorded striking action of such treatment in limiting the spread of the lesions.

Since some patients do not tolorate tartar emetic well when it is given intravenously foundin and trivalent compounds of antimony may be employed and fouadin may be garen intramuscularly and even sub cutaneously with very negligible local reactions. The official dose is 16 cc. gnadually increased to 5 cc. every day or every alternate day and a total of 40-50 oc constitutes the complete treatment.

Surgical Treatment—Scrapings and the application of the actual cases; have been recommended Temporary improvement may be obtained but the infection usually reappears in the scar tissue Excision can usually only be successfully undertaken in the very early stages following which ship grafting may be advissible Yarash have been emploved in early cases with good results. In other cases such treatment has produced no favorable effects.

Prevention —As the disease is evidently spread by sexual contact prophylaus depends upon the avoidance of sexual intercourse with native women hable to be or actually infected

Rinuarderema has been reported in most parts of the world but at the present time is more common in many parts of the tropics. It takes the form of spontaneous painless and very chronic inflammatory growths which many occur in any part of the respiratory passages from the nontrils even down to the hilum of the lung. It has recently been noted in India by Rao and Menon where 6 cases were observed. In 4 the characteristic histological changes were seen and the organism Basiliar or Inlepsided rhinosicleromaths was present. In case the organism was isolated in culture. Kullman (1641) has also reported a case from West Java

The most satisfactory treatment is mainly surgical Recently good results have been reported from a rays or radium

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Chapter XXXIX

CLIMATIC BURO

Synonyms -Tropical bubo, lymphogranuloma inguinale, poradenitis Nicholas Favre disease

Definition -A specific infectious venereal disease characterized by a transient primary lesion often undetected followed by a subacute lymph adenitis with eventual supportation formation of fistulae and finally cicatricial healing. The suppurative state is usually accompanied by lever and general constitutional disturbances It is due to a filtrable virus

The name lymphogranuloma inguinale may be confusing since it is so similar to that of another disease, granuloma inguinale which is an infection with an entirely different etiology Stannus (1913) proposed the name sixth venereal disease for lymphogranuloma inguinale to distinguish it from (1) syphilis (2) gonorrhea (3) chancroid (4) Vincent's infection of the genitalia (fusospirochaetosis) and (s) granuloma venereum

A distinctive reaction known as Freis skin test enables us to group under climatic bubo various chrical states which may or may not show

inguinal buboes

History and Geographical Distribution -Scheube first employed the climatic hubo to a type of adenitis terminating in suppuration not uncommon in tropical countries Stitt (1929) points out that naval surgeons of various countries have for many years observed and been interested in its origin. It seemed to affect particularly the crews of In earlier years it has been frequently confused with a mild infec tion known as ambulatory plague. It has long been recognized in the Far East and in Africa among Furopean sailors Numerous reports of its occurrence in India China Malaya, Japan the Mediterranean the West Indies and South America have been made. Finally its presence has been noted in Africa and especially in the Belgian Congo by Chester man (1938) Durand Nicholas and Favre (1913) reported upon the disease in France under the name lymphogranuloma inguinalt subsequently was found to be common in the United States chiefly among the colored population Cases have also been found to be not uncommon in England and in many parts of Europe Hanschell (1018) has observed 130 cases in males in London in all of which the infection was acquired in the tropics or subtropics

ETIOLOGY

The Virus -I he first definite evidence that the etiological agent is a filtrable virus was reported by Hellerstrom and Wassen who showed that the intracerebral injection of certain species of monkeys with material 1118

obtained from human lymph nodes gave rise to a meninge encephalitis which could be transmitted in series after filtration through Berkefelt V or Chamberlain L₂ candles Later it was shown that monkeys could be infected with the virus into the prepure with subsequent enlargement of the inguinal lymph nodes Findley (1936) also produced infection experimentally by placing the infected material on the scanfield skin

Levadit (1932) discovered that the virus of lymphogranuloma ingui nale can be transmitted to mee by intracerbeal inoculation. Virulent strains give rise to cerebral symptoms in mice 2-4 days after injection. In addition to the production of meningitis in monkeys and mice such infection has been produced in the cat and in a number of rodents. Intracerebral inoculation of suince pass results in membratic lesions in only a

small percentage of the animals

It has been found possible by subcutaneous injection of lymphogranu loma inguinale material to produce buboes in the groins of guinea pigs but the infection tends to be a self limiting infection the swellings occur ing about a days after inoculation and remaining palpable only from 10–14

days

Reports have also been made of the isolation of the virus from inflamed rectal tusues and from an inflammatory condition of the colon by Levaditi (1933) It has also been transmitted to animals from a case of con junctivitis by Levaditi (1936) and Pomhamm has isolated it from the creebro sound fluid in 2 cases.

In regard to the presence of visible organisms in the virus Gavand Prieto (vg. 7) reported the presence of small cytoplasmic granules in the cells from ingunal buboes 12 or less in diameter and often occurring in small clumps. These granules were also described and illustrated by Findlay 1933. He suggested the possibility has they represented the virus. This possibility has now been increased by the work of Milyagawa and his

colleagues (1036) and Findlay (1030)

The granules in stained preparations appear either single in pairs or in short chains. Sometimes arranged to form a circle. Less commonly they appear in dense clumps comprising hundreds of minute bodies. The distribution of the virtue as shown by filtration through graded coloidon membranes are similar to those of vaccinia virus annelly o 175 µ to 175 µ (Aliyagawa 1935. Broom and Findlay 1936). The virus has been cultivated upon the cherocalantoe membranes in tissue culture (Alivagawa). Tamura (1934) by using Tyrodes solution with sterile animal tissue also reports cultivation of the virus. Original cultures were made from filtrates from gland pus and repeated transfers made successfully. He noted that the cultural antigen gave as marked reaction as that of Frei. He also used this heated antigen therapeutically. (See Chapter VaW for classification of this organism.)

PATHOLOGY

The swollen glands at first may be just palpable. Later they some times become the size of a hen's egg. At first the glands are discrete and

not attached to the sun Later on periadentis may occur and they may become firmly attached to the surrounding tissues by inflammatory evudate. The overlying skin is intact as a rule but at times a soft cert may be felt in the otherwise hard gland and their may be much ordern of the surrounding tissues sometimes resulting in elephantiasis. Knab has reported an instance in which there was rupture from a lympho granulomatious supportating area into the urman; bladder.

The most striking histological appearance in sections of the early huboes consist of minute inflammatory foci scattered through the gland substance in which lymphocy tes and later endothelial phagocy tes plasms cells and cosmophiles are abundant. Still later, polymorpholeuccytes predominate and small abscesses form and necrosis of the glandular structure occurs. At the periphery there may be noted hiemorrhage infiltrations and oedema in the region of the peripheral sinuses with formation of fibroblasts fibrous connective tissue, and a few giant cells. In some instances, when an incision is made into the center of these glands a visible necrotic area is found. Cultures prepared on hacteriological media under anespitic conditions from the necrosed areas remain sterile. In many instances considerable pus is gradually formed within the gland although the skin above remains unbroken.

The infection spreads by the lymphatics to the deeper glands especially in the female, from the vagina and the anterior part of the vulva and from these localities posteriorly to the rectum resulting in the gentio and rectal syndrome sometimes with ulceration. Fistulous tracts may form from which there exudes much clear sticky mucous faud. Finally, sciencist of the gland tissue may occur leading to rectal stricture.

Staned microscopical preparations of the discharge, or of sections of the buboes reveal that in the mononuclear or polymorphonuclear cells there are minute particles. With Geimsa stain the larger ones take on a purplish tint while with Casteneda's stain they assume a reddish purple tinge. Larger and smaller forms of the virus particles have been demonstrated extracellularly forming compact, colony like masses. The larger forms have been observed in considerable numbers chiefly within 24 hours of intracerebral inoculation of animals. These virus particles were first noticed in the cells from inguinal buboes by Gay and Priction in 1977 and by Findlay in 1933. Finally Myagawi (1938) has brought forth additional evidence that they represent virus particles.

CLINICAL OBSERVATIONS

The disease is much more common in males than in females. Children have not been reported in suffer from it. Lymphogranuloma ingunale in the male is usually characterized by inguinal adentits. Later elephantic assist of the genitals may occur and rectal stricture is not rare. In the inease, the characteristic lessons are esthnomene, chronic ulceration of the vulva perincum anus and rectum fistula formation and rectal stricture their combination forming a genitic anniversal systems.

The Fre test has enabled us to group and recognize as forms of climate bub obth the ingunal buboes so common in males and esthormene (vulvar elephantiasis) and the gentio ano rectal syndrome of females Ingunal adentis in the female is relatively rare but does occur. In man the initial infection is usually of the coronal sulcus and extends by the penile lymphatics into the ingunal glands and thence sometimes to the deep line glands. The latter usually do not suppurate. The intra pelvic glands are that resually do not suppurate. The intra pelvic glands are the ones usually involved and this leads to pen salpingitis pen rectal infection and subsequent rectal stricture. The variation in form of the disease according to sex is particularly the result of conditions regarding the site of the inoculation and in the distribution of the lymphatic drainage as the infection extends almost entirely by the lymphatics.

Vander Veer et al. (1955) in 47 cases noted 2: cases of rectal stricture—all in the female and only 3 of these in the white race. The common location of the stricture was from 3-5 cm from the external sphinter. In the Frei testing of prositutes there may be obtained positive reactions in the absence of clinical sizes in a small bereintage of cases.

It has been stated by some observers that climatic bubo appears without an initial lesion as is recognized for chancroidal or gonorrheal huboes But the present view is that there is a primary sore which may even resemble a chance or be so small beneath the prepuce as not to be detected Hanschell (1938) emphasizes that the primary lesion is frequently undetected. In his 1.0 cases in the male it was observed in only 4. The lesion, when it does occur has been described as a papule vesicle nodule or small ulcer. In some instances it has been reported to appear from 3-5 days after coitus and is generally painless In many cases it disappears in 7-8 days In Hanschell's cases however the primary lesions were still present from 14-21 days after their first appearance. The swelling of the groin is usually noticed by the patient in from 1-3 weeks after the infecting coitus. Hanschell believes that the primary lesion of the woman's vagina probably persists for a much longer time than it does in the male Chesterman (1938) found the primary lesion in women generally to be an ulcer on the labia or vestibule

The disease has been divided roughly into 3 stages the primary one including the incubation period extending from the time of infection and appearance of the primary leason up to the symptoms pointing to infection of the lymphatic glands. The secondary stage representing the definite infection and swelling of such glands. In the male it is especially the inguinal glands which become involved. In the female the most usual early signs are of periorical and retroperational gland involvement and may not be noticed by the woman. In the grown the leasons in men and which are occasionally encountered in women in China. Japan and France are characterized by stiffness and pain and swelling. The inflammation may be unitlateral or bilateral. In some mestances one grown is invaded

after the other The reaction may subside without suppuration. Honever, the glands often suppurate and multiple areas of softening occur followed by the production of many fistular. The deep thice glands also often show an increase in size and sometimes the lumbar ones, but with the exception of several cases in which the point of infection has been truggential the glands of other parts of the body, as the axillary and cervical have not been involved.

In a large number of eases the adenius is accompanied by constitutional symptoms such as chills aweats, fever, prostration amoreus, and comiting pains of the chest and muscles stiffness of the heat headache epistaxis and frequently bronchits. The discharge of pus, or suppuration of new glands may continue for a few needs to many moints or longer. In such cases the fever may be high and undulating or typhoidal in character, and may persist for weeks as new nodes are involved. In some cases skin rashes have been reported at times scallatiniform or resembling those of crythema multiforme. Conjunctivity and peripapillary odema of the cythorna have also been observed. In some instances rheumatic like pains and poinfuleffusions may occur in the larger joints during the pyreual stages of tropical bubb. Healing of the inguigilands when it eventually occurs after several weeks, or in some instances months, gives rise to extensive formation of scar tissue.

The tertiary stage of the disease is characterized by chronic ulcerations the formation of fistulae and of rectal stricture. In the female, it is not uncommon for the ulceration to give rise to a cloaca between the vagina and the rectum. Genital elephantiasis, particularly of the labas and valva or penis and scrotum as a result of blocking of the 1) mphatics may also occur. In 3 out of 6 cases in women Chesterman (1938) observed anal vaginal histulae. During the tertiatry stage death may occur from

secondary infections

Some observers have been doubtful as to whether all cases in which then has been a gentio and rictal syndrome or stricture of the rectum are cases of climatic bubo. However Frei found that 80 per cent of such

cases that he observed gave a positive skin test

Extra genital infections have been recorded in a few instances. Curth has reported a primary infection of the tongue and lip followed by glandu lar enlargements in the neck while Hellerstrom has observed an infection in the glands of the axilla and Lepinay and Grevin have described a primary infection of the foot. Hanschell (1938) has also reported an infection of the finger with the virus with subsequent adentits of the epitrochlera and avullary glands.

A number of human cases have been reported with symptoms of meningitic involvement which is not surprising in view of the fact that a fatal meningitis may be produced by the inoculation of the virus into animals. Chevalier and Barnard (1932) have reported chronic menin gismus in a somain with lymphogranuloma inguinale the cerebro spinal fluid showed the presence of an excessive number of cells and considerable albumin and gave a positive Frei reaction when injected intradermally

Two other somewhat similar cases have also been reported and Rajam (1936) has recorded a fatal case of meningths in which the cerebro spinal fluid also gave a positive Frei test on intradermal injection. David and Loring (1935) observed epileptiform convulsions in a patient with ano rectal lesions which had extended to the colon. It therefore would appear that just as in experimental animals the virus may also sometimes invade the human central nervous system.

Blood—Evammations of the blood have hown that there may be characteristic blochemical changes such as a decrease in the lipin content and an increase in the percentage of free cholesterol (Rosen and hi asso cates 1937) Williams and Gutman (1936) have reported a hyper proteuments with an increase in the globulin and decrease in the albumin content of the serum When the glands suppurate there is usually a leucopytosis.

DIAGNOSIS

The disease must be differentiated from ulcerating granuloma (vene real bubo) chancrodal and sypbilitic buboes and from the ambulant form of mild plague. In Hongkong in earlier years the infection was

frequently termed pestis minor

Plague bubbes are usually exquisitely tender and the patient usually manifests signs of illnes which are often extreme Puncture of the bubb if the case is one of plague will reveal Beachilas pestix. The glands in chimatic bubb are not exquisitely tender. In symbilis the glands are generally harder and the enlargement of the glands is usually general. The redness overlying the skin should usually differentiate the other veneral bubbes. In the case of granuloma venereum. Donovan bodies are present.

More accurate diagnosis however may be determined by the follow

ing laboratory tests

Diagnosis by the Frei Reaction—Frei (19 5) described an antigen prepared from the clear and sternized pus of unraptured bulbos of ly implo granuloma inguinale. The antigen is made by diluting material aspirated from bulboes or an emilsion of infected mouse brain with \(\gamma\) to \(\gamma\) by garts of saline. The mixture is heated at 60 \(\int \) for on minutes and on the succeed.

mg day for 1 hour at 60 C.

The allerges tate develops in from 2 to 4 weeks after the appearance of the bubo. The skin test is most marked after 24 to 48 hours and peris 1s for 5 to 10 days. Some observers read the reactions after 2 days. It ranges from redness with or without induration to vesicle formation and the formation of a nodule. About or cc is injected intraculaneously in the forearm—a saline control on the other side is advisable. Vander Veer considers the Frei test is best read after 4 to 5 days. Non specific reactions usually subside after this interval. A positive result con ists of the development of an inflammatory paulie or nodule at least 6 5 cm in diameter often with the appearance of a peripheral crythema and sometimes a central pustule persisting for from 5 to 10 days.

In regard to the Frei test, Wassen (1935) in human cases experimentally infected, found that the test may become positive in 6-13 days after infection and may remain positive in some cases for a year and in cases involving the rectury it persisted several years.

Hanschell obtained a reaction in a case 21 days after exposure to infection and found that it might persist for months. In one of his cases he found it was still present 12 months after discharge from the hospital However in 3 of his cases a negative result that is an erythema only, was obtained 1-30 days after exposure but fatter, 42-51 days after infection the same antipen gave positive results that is rythema and nodules

Free (1938) states that on account of the possibility of generalized or local reactions, it is not advisable to make the test in perscute stag s of the disease, or in cases in which suppuration occurs near the penneum

Nelson (1939) points out that the positive test is not proof of disease activity for the test may reman positive for years after healing. According to Free, it may be negative in the early stages but will be positive in 35 per cent of the cases with bubo and 40 per cent of the cases with bubo and 40 per cent of the positive in it. In the early stages if the test is negative put from the patient injected into a known case of lumphogranuloma produces a positive test but Frei advises caution in the use of this inverted test because of false reactions. Since only pus from unruplured buboes may be used it is often difficult to secure the antigen. Therefore many investigators have attempted to produce autigens through inoculation of many animals as mice rabbits guinea pigs monkeys dogs and goals.

Since mice are very susceptible to the virus by brain passage the antigen has been especially prepared from the brains of such mice. The difficulty in the use of these animals lies in the fact that the virus cannot he easily standardized nor is it known just how long it remains active.

Grace and Suskind (1936) have reported a method of standardizing mouse brain antigen so that it is as reliable as the Frei antigen. The virulence of the virus increases on mouse brain passage and with this increase the antigenic power is enhanced. Mice weighing o Gm were inoculated with a uspension of virus of a virulence sufficient to kill from 85 to 100% of the mice in from 5 to 7 days. The brain of such a dving mouse was emulsified in sterile saline in such an amount that the heated product produced a papule not less than 7 mm in diameter in an infected Using the eighty eighth pas age of the virus they found that o r cc of a r m 13 dilution gave a papule varying from 7 to 10 mm in When unstandardized mouse brain antigen was first u ed there were reports of reactions with the brains of normal mice as well as of those containing virus but these reactions of normal mou e brain did not give rise to a papule exceeding 5 mm The products of tissue disintegra tion whether in normal mouse brain or non specific pus are capable of projucing a reaction on intradermal inoculation but not equal to that of a virus containing material

There is, however great difference of opinion at the present time as to the specificity and value of the mouse antigen for diagnosis White

some have believed it specific Straus and Howard (1936) and Brinkley and Love obtained falsely positive and doubtful reactions. They also secured false positive reactions with normal mouse brain

Findlay points out that a negative reaction with mouse virus may be due not to absence of infection in the individual but to failure of antigenic potency in the material insected

Occasionally when the intradermal injection of o i cc of the antigen

is negative the injection of o 3 cc may produce a positive result

Findlay has found if the antigen is filtered through a Berkefeld V

filter the filtrate is still capable of producing a positive reaction but pas sage through a Seitz K filter which removes the greater number of elementary bodies also greatly reduces or usually inhibits the antigenic capacity of the filtrate

Rake and 'Shaffer (940) have prepared manctivated suspensions of elements y bode advented in the peydik at and sep a tell from insuse constituents by different's cent fugation and such suspensions have been successfully employed a antigens for the Fre test and for the demonstration of compilers it was greeners in the serum operions infected with the virus. The latter te taugh is to so it mus from mouse in g have all been used They also behanded such each of with State Ek die efficiency is disappended and the supplier of the suppliers of the su

Nig and Bouser (1943) believe that the complement fixing sit gens s c enhanced by t cating the suspensions with i henol and subjecting them to boll g temperature This type of ant gen is as d to rule out at lea t some of the nonspecific reactions in hich

occur in early syphil

Smadel Wertman and Reagen have found that it is impossible to differ that shalply between human partitions and hymphogranuloma by means of selological test though in a men it, cost it is possible to establish that a given scutte illness a caused by a member of this group of viruses

H nucbell has carried out the cont. I nitadermal test al. as in connection with the Dimelcos chin out wate. In amous forms of enereal disease other than chin matter bubb he only brained negative reactions with the viru of climat c b b However in some of his cases of climate bubb othe antigen has given epeatedly nevative railts and the circle of he between that no e of click he be not the railts and the circle of he between that no e of click he be given the railts and the circle of he between that no e of click he be given the rail of the sixual of the six

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Several other tests have been described for diagnosis. The Wassen test consists of the production of a fatal encephalisis in mice by incoulation of the virus. Another intracerebral test in mice has been employed in which a mixture of one part of a 10 per cent suspension of infected mouse brain and two parts of the serum to be tested is inoculated intracerebrally into mice in doses of 0 g cc. A control batch of mice is similarly inoculated with a mixture of normal serum and indected mouse brain. With an active virus the mice injected with virus and normal serum should develop symptoms in from 5-10 day.

TREATMENT

Treatment of the disease is often not satisfactory. However in mild cases there may be a rapid subsadence of the bubbes after a few days rest in bed with no other treatment. In some cases wet compresses and light mercurial continent inunctions over the bubb at night have apparently been of value. In the early stages of the infection, the inflamed gland if discrete may be excised. Manson Bahr has reported notable success by

1126 TREATMENT

such a procedure. In cases in which there is fluctuation of the bubo indicating pus Hanschell recommends that the buho should be aspirated and the puncture then sealed with all aseptie care Aspiration may have to be repeated on several occasions. The hubo should not be incised. He advises especially in these cases protein shock therapy with typhoid or paratyphoid vaccine Manson Bahr has also employed such treat ment commencing with 50,000 000 given by the intravenous route and gradually increasing to 200 000 000 or 300 000 000 the injection being given every third day He found that two or three reactions were usually required before the buboes dried up and the surrounding induration dis appeared Treatment should be combined always with rest in bed and with antiphlogistin dressings Hanschell reports that by the intravenous injections of such typhoid vaccines, no other treatment was given in 8, per cent of his cases and after 4-6 weeks the patients were discharged In the remaining 15 per cent operation was advisable consisting of excision of the affected glands He points out that there may be diffi culties in the operation and that the glands are often adherent to the spematic cord femoral vein and the external iliac vein

With reference to surgical procedures in advanced eases there is danger of the further spread of the infection through the lymphatics and incisions into suppurating sinuses or the removal of large masses of lymphatic tissues may be very dangerous. Often excision of the mass when suppuration is present is not followed by clean and rapid healing

Vaccine Therapy -An attempt has been made to prepare a specific vaccine by excising portions of the affected glands which have been cut up into small pieces dehydrated over calcium chloride and suspended in saline solution. The suspension has been injected in increasing doses every second day No reliable reports have so far been made of the value of this method Bereovitz has advocated intensive treatment by sub cutaneous injections of Frei antigen However, he reports improvement was very slow

Drug Treatment - Hanschell states that there is no satisfactory evidence that any drug has any effect on the disease. Intravenous injections of tartar emetic have been employed for some years Wolf and Van Cleve (1032) reported the best results with a 1 per cent solution of antimony potassium tartrate given intravenously twice a week From 10-15 doses of from 5-10 cc have been employed Others have employed the penta valent compounds of antimony as stibenyl and stibosan Solganal either intramuscularly or intravenously has been recommended and employed extensively in Germany However recent clinical and expen mental observations in the treatment of diseased conditions with gold salts have emphasized their toxicity and the dangers from their use Hartfall Garland and Golvid (1937) in a review of 900 patients with rheumatoid arthritis treated with gold salts found that 40 per cent showed toxic effects Deaths from the use of such compounds have been reported by Goldhammer (1935) and Anderson and Palmer (1940) and there is no specific antidote known for such cases of poisoning. In view of these reports and of the toxic effects of the drug on experimental animals such treatment must be recognized at least as dangerous although several

clinicians still advocate its use in the treatment of arthritis Moreover Manson Bahr states that he has had little success with this method

Treatment of Rectal Stricture—Bensaude and Lambling believe that dinatherms dilatation is the best method of treatment applied for so minutes over 2 or 3 days from 10 to 12 applications. Oil soluble local anaesthetics such as protocoain are recommended for post operative rectal pain. Medicinal treatment of rectal stricture esthomene consists especially of injecting antiseptic solutions to aid in curing the ulceration. Several observers have reported success by the introduction of sulfamila mides. It is not entirely clear that the virus of lymphogranuloma may be destroyed by sulfamilamide but in cases of bacterial infection of the lesions particularly with streptococcus their use obviously may be of value. Shropshear has reported success with sulfamilamide in does of a grams daily for 15 days with a 7-10 day interval when the course should be repeated. Two patients required 108 grams in two 15 day treat ments before the symptoms disappeared. C. M. Morgan (1930) has also reported good results in the healing of the rectal ulcers with protonsil.

Redanche (9a,) ha found that the vrus mt the brains of muce is oit. If d by sulforanticle but he was not able to cert in cert if the spleen of the mp of the cast teated. However mo rece to the Nece Cotelboard Cohe. Bad thand for n bit this emphs of the value of the sulf a mide drugs buildarbar lamb been thought to get the best result sulfandam that is, case of many touc reactions. It supposes the sulfandam of t

The t atment of th an ectal d sease 1 w wally less satisfactory

Fetna d Be chenko (943) ob erved 36 cas s now 4 my n 6 m nth t St t n h spital in India In 6 of the; cas ne cou se of o al sulf lamide was found to be d quat to produce a ue

Le (64) at the top by West Minca ha observed also cases 33.1 To operan He errphasters the mportance of 1 at m at that no y compound pc ll), with Anthonaline (lithium ant m) to trate thomalate) adm stered not amuscula ly and hasse ed in the butte. Intransacidal rungerious were go en z to times weld, womann ing with a dose of o see up to soc. A maximium total of oingee weld, we have a distribution of the contraction of the case intiate. I dum antiomous tarrature was emplyed. He che distribution to the contraction of the c

Treatment with ultra voilet rays and radiant heat have apparently proved of little value Operative measures depend especially upon the character of the lesions and the type of structure present. In some instances excision of the stricture of the rectum and even colostomy have been recommended.

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Chapter XL

DISEASES OF RARE OCCURRENCE OR OF DOUBTFUL ORIGIN

Sarcosporidiosis

Sarcospondia are a group of muscle inhabiting spore forming proto zoa the affinities of which are unknown. The species have been placed in a single genus (Sarcospiti). They are parasitic within the striated muscle fibres of many mammals (especially pigs mice sheep cattle and horses) and occasionally of birds.

The sarcocysts (Miescher tubes) are elongated tubular bodies which distend the muscle fibers and may reach a length of 16 mm The tubes are subdivided into numerous chambers which are filled with sickle or oval shaped spores (Rainey s corpuscles) 7 to 154 long and 3 to 44 wide There is an enveloping capsule for the sarcocyst which may show striations The life history is unknown Mice can be injected by feeding them the spores Heavy infections may be fatal especially to mice but light infections are harmless. In some places more than so per cent of the sheep and pigs may show infection The parasite of sheep has been named Sarcocystis tenella that of the ox S blanchards that of the mouse S muris

Ffeiler (1897) Jound that a powerful to un which in small doses would kill rabhits was secreted by Sarcocystis murs: He believed it was through this means that the parasite was able to penetrate the intestinal epithelium of the mouse its normal host

The parasite has been rarely found in man there being only ro appare ently authentic cases reported. The first of these was reported by Linde mann (1868). Two were reported by Darling (1909 1912) one by Lambert (1927) and one by Feng (1932). Hettig (1934) also reported a cross in a child in which an organisms found in the tissues appeared to be

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Fig at 3—Sa y f m 11 numuele of m (4ft Ngr1 190) from 25 m on 11 ngth fifty d 1 ft f d ng 1 ft m 25 m ns 1 ngth fifty d 1 ft f ng 25 m ns 1 ngth fifty d 1 ft ng 25 m ns 1 ngth fifty d 1 st f ng 25 m ns 1 ngth fifty d 1 st f ng 25 m ns 1 ngth fifty d 1 st f ng 25 m ns 1 ngth fifty d 1 st f ng 25 m ns 1 ngth fifty d 1 st f ng 25 m ns 1 ngth f ng 25 m ns 1 ng 25 m ns 1

best classified as Sarcocystes in which there also was a bacterial infection with a coccus *

The human parasite has been designated as S lindemanns. It is perhaps identical with one of the Sarcosporidia found in mammals While the exact method of transmission of the parasite is unknown as the mouse can be infected by feeding it the facces of other mice infected with S muris it has been suggested that man becomes infected by food or drink contaminated with the faeces containing the parasite. The use of infected meat according to the reports seems to have no injurious effects Probably the human infections are accidental

Diagnosis has been made by the finding of the Meischer tubes in sections of the muscle No specific treatment is known

Craig (1940) points out there is little reason to regard the sarcospondia as Protozoa and it is much more probable that they belong to the Fungi

TOYOPLASMOSIS

Toxoplasma was the term applied by Nicolle and Manceaux (1908) to a protozoan observed in a North African rodent the gundi (Cteno dactylus gundi) They named the parasite Tovoplasma gondi: They believed it was distinct from Leishmania Splendore (1008) in Brazil reported a similar organism as present in the rabbit Both these parasites were inoculable into pigeons Shortly before Laveran (1900) reported a similar parasite in sparrows There have been reports since of the natural occurrence of a similar organism in a large number of animals as wild birds and pigeons the rabbit guinea pig mouse rat squirrel dog and monkey in many parts of the world, the diagnosis being based on the morphology of the organism found

Sabin and Olitsky (1937) described the organism in North America as observed in guinea pigs. They isolated and maintained a highly

nathogenic strain from this animal and found that

(1) The strain was pathogenic for guinea pigs mice rabbits thesus monkeys chicks and chickens (2) multiplication was possible only within living cells which included not only monocytes and endothelial cells but practically every type of parenchymal cell (liver adrenals lung brain) (3) infection could be effected experimentally by the intracutaneous subcutaneous intracerebral intravenous intranasal and oral routes and contact infection studied in mice occurred only when small numb is of started animal were allowed to feed on others recently dead of the experimental disease (4) neutralizing antibodies which could be used not only as an index of infection but also as a means for identifying Foxoplasma developed during the course of the disease in some animals (thesus monkeys) but not in others (rabbits)

The organism was reported to consist of distinct cytoplasm and nuclear chromatin and was crescentic pyriform oval or round measuring 6-74 in length and 2-44 in width depending on the stage of development as seen in fresh cover ship preparations or in stained films. In fixed tissue sections they were not only smaller but also appeared different because of the shrinkage of the cytoplasm and nucleus. The chief taxonomic characteristic of the group however was the capacity to Gilmore Kean and Posey (1942) have reported the twelfth case in which the

parasites were found in the beart (Am Jl Trop Med 22 121 1942)

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multiply and produce disease in a wide range of hosts including mammals and birds

Toxoplasma has been reported on a number of occasions as causing disease in man but with inadequate and inconclusive criteria

Catellan described bodies which he believed to be Texaplasma in smears of the blond and splene of a 1 year old boy from Cerplon who d oid of a disease characte wed by severe anaemia, priol ged fever and splenomegaly. Fedorovitch found bod es similar to hose reported by Catellan in blood senses of a 0 year old boy from the Black Sea di trict who also had prolonged fever anaemia and splenome aly Chalmers and hamme also reported bodies similar to those of Castellani in a film of the spleen of a soldier in the Sudan who also along with many others suffered chiefly from chronic fever headache cough and d'arthora.

Wenyon (1936) doubts the reports of the human infections related above and say, that it is perfectly clear in at least some of the instances that no such parasite as Toxiplatine evisted. He points out that vege table cells will often give rise to similar pectures and that such cells each of the control of the cell to the control of the cell to the cell

Wolf and Cowen (1937) have reported a case of congenital granu lomatous encephalomyelitis in an infant who died at 29 days of age They reported parasites found with ease in the sections of the nervous system. They were smaller in size than those recorded for Tovoplasma and they named the organism Encephalito oon hominis. Six other Tovo plasma infections have been reported in infants. In the case reported by Wolf Cowen and Page (1939) the parasite obtained was apparently armilar to that found by Saba and Olitisk,

Sabin (1941) has also reported a cases of a typical encephalitis occuring in boya 6 and 8 years of age. Tore plasme was obtained in one and sug gested evidence in the other. The chief pathologic change found in the nervous system only after many sections from various regions had been searched consisted of microscopic necrotic and granulomatious foci in the vicinity in which it was occasionally possible to find structures morphologically similar to Tore-plasma. Intracerbertal and intra abdominal inoculation of fresh brain suspension produced toxoplastic infection in 5 of 8 mice.

S of o mee
Pankerton and Henderson (1941) have reported z cases of an acute
febrile exanthematic disease in which the gross and microscopic appear
ances were remarkably similar to those of typhus and spotted fever.
They point out that the clinical features of the disease in their two cases
had almost nothing in common with those of the previously described
cases of neonatal infection with Toxoplasma their cases being essentially
those of an acute febrile exanthematic disease with atypical pulmonary
involvement and in fatal cases death from respiratory embarrassment.
In one of these cases the broncholes contained macrophages distended
with the organisms while in the other case a massive infection of the
myocardial fibers with the parasite was seen although the invaded fibers
were not numerous and were unaccompanied by reliable in militation.

They were not present in all sections of the myocardium however and in the first case only one invaded heart muscle fiber was found after prolonged earch They say that staining of the organisms in the cyto plasm of cells requires further study. In many apparently well stained sections, the organisms appeared as homogeneous spherical cosmophilic bodies which could easily have been mistaken for colloid droplets or other structures of a nonspecine nature, while in other sections from the same paraffin block stained somewhat differently their structural detail was clearly visible

In a study of human cases where the diagnosis has rested particularly upon the inoculation of the animal and the finding of Toroplasma subse quently in the animal, Pinkerion has pointed out the danger of causing a prior latent infection with Toroplasma to develop in the animal which was not demonstrable before

Pinkerton and Weinman (1940) have also reported another case which they described as Toxoplasma infection in a Peruvian Honever this patient was also afflicted with Bartonella infection and had been given intravenous injections for treatment and at autopsy a secondary bacterial infection with cocci had occurred which was demon strated both by films and by cultures

As has been noted organi m identical with Toxopismo have been found to be very common in wild birds but whether all the forms morphologically resembling Toxo pissma really are uch has been questioned. At present it is controversial as to whether certain forms which have been described in rialaria infected birds are Taxo plasma or species of Plasm diam Nanwell (1939) has emphasized the difficulty of distinguishing between experithrocytic schizonts in bird malaria and developmental forms of Toxoblasma. The nature of at least some of the organisms reported in human cases as Toxoplasma is not entirely clear nor has their relationship to protozza lungi or bucteria yet been clearly demonstrated

Perrin (1943) has studied the pathology of experimental infections in animals and Weinman (1944) has e pecially studied the chronic infection in animals and he reports

that sulfany riding is strikingly succes ful in curing acute infections in mice

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ONYALAI

Onyalan is a disease which has occurred in parts of west east and south Africa and is of observe origin. It is characterized by the appearance of blood distended vesicles of the mucous membranes of the cheeks and hard palate. The tongue is often swollen. The skin may show haemor rhages and haematuria may be present. The blebs in the mouth may vary in size from r— cm. A study of the blood shows that there may be some anaeman and in the fatal cases there is a sudden drop in the red blood corpuscles shortly before death. There is a marked decrease in the number of blood platelets. The blood shows a normal coagulation time but there is usually a prolongation of the bleeding time. There may be some fever. The disease usually engenders fear in the African natives in the districts where it occurs owing to its sudden onest and high mortality.

Wellman reported its occurrence in West Africa in 1904. In Northern Rhodesia Wallice reports the disease is called Chalopa or Akambe (bleeding disease) while in the Congo it is known as Kafindo. Wallice in No thern Rhodesia observed it cases annually. The onset was sudden and the early symptoms in creasitude general dulletss and mittouron of the computed view with every of you for followed by the wide

apread hemorrhages

Bla kie (rosz) notes that it occurs in Angola and Portuguese West Africa Lual ha River and near Mt Kenya as well as in the Rhodesias He studied 7 cases one of which was fatal The reduction of the red cells was rap d and was ascribed to loss of blood from mucous membranes and baemorrhagics infiltration of t saues and organa The anaemia was of the normal achimmic type as met with generally after severe acute haemorrha e There was a remarkable reduction of the circulating platelets at the onset these being reduced from the no mal range of 250 oop to 500 oop per cmp to hetween 20 000 and even less than 1 000 With this there was associated a marked prolongation of the bleeding time Shelley (1938) has reported a case fr in Southern Phodesia where the man had been working in the mi es for 6 years. He w a of n or physique. There were haemorrhagic vesicles on the muco a of the checks and soft palate and heneath the epithchum of the tongue One was as la ge as r X 12 inch The gums were soft and anongy The red cell numbered \$ 450 000 There were a few normoblests. The white cells were 6000 the platelets 170 000 per cmm, the reticulocytes r s per cent the haemoglobin 65 per cent. The bleeding time was oly minutes or nearly a times normal and the clotting time a minutes

Gear (1938) has reported 7 cases occurring in South Africa 3 ended fatally Among the patients was one woman and the ages ranged between 20 and 40 years Symptoms were practically the same in all sudden onset with feeling of lassitude then soreness of the tongue gums and buccal nuccos with rapid formation of blood blisters and profuse haemorrhage from the mouth nose and blood filled blebs or petechae on the surface of the body. He notes that passage of blood in the turner

and faeces may also occur

In Gease c set the blood filled bullae varied in size from that of a pea to 13/2 inches in dismeter. In some cases the eyes and face are suffused and swolfer and the proted glands enlarged and tend r. Treatment by them states is of little avail. The anatrum in severe cases is usually pr found and in fatal cases death may t ke place within a neeth.

At autopy all the organs and tissues show petech as. In one of the cases reported by Gear (1933) a larger to bril haemorrhage was the immediate cause of death. Retraperationes! and permer. I haemorrhages and haemorrhage bronch pursue in a common. Gear rep. it also that the sphere may be a little enlarged and fin ble. He found that generally there is but this chauge from norm. In the number of crythorouse or leucocytes but in fatal cases naturally there was a severe drop in the former the color index varied from 0 8, to 0 98 in those who recovered

The bleeding time was prolonged in his cases, but the coagulation time showed little if any departure from the normal. The chief characteristic was marked reduction and almost complete absence of platelets. In a cases examined megalaryocytes were present in normal numbers in the bone marrow and there would therefore seem to he an inhibition of the normal maturation of platelets.

Hellman (1938) has reported 5 cases among Hottentots 3 of which were in women hetween 55-65 and 2 men 40-45. Thinking the condition might be scontiute he prescribed orange fusice and an antiscorbute dell' Autohaemotherap; was then employed 20 cc being injected intra muscularly and this was followed by rapid recovery. Two of the patients received only one injection. In 3, it had to he repeated but only once Up to the time of the report once had any return of the symptoms though the first occurred more than 3, years before. Blackie also found that the most efficient treatment was by blood transfusion and autohaemotherap. He miseted 8cc of blood intramission and autohaemotherap.

haemotherapy He injected 18 cc of blood intramuscularly
Shelley in his case injected ro cc of the patient s whole blood intra
muscularly In 4 days the vesicles disappeared and the general condition
improved and the patient left the bospital ry days after admission

Gear found that intravenous blood transfusion is less efficient in treatment than small amounts injected intramuscularly. This suggested to him that there might be a deficiency of some factor in the whole blood which stimulated platelet formation when it came into contact with the tissues. He concluded that the best treatment was an intramuscular injection of 20 cc of the whole citrated blood. When this treatment was conceided at did so rapidly. Prior to the onset of the illness of his 7 cases the patients had been in good health and were living on a liberal mixed det.

Plaut (1939) has reported a case of aplastic anaemia somewhat resembling onyalas, though the characteristic hlood blisters in the mouth were not seen Transfusion and haemostatics were ineffectual. There was a rapid reduction in platelets. In less than a fortnight they were too few to estimate. Death occurred 22 days after admission. Intra muscular injection of whole blood was not tried.

Snelling (1938) has described from New Orleans 3 cases which have points of considerable similarity to onyalar

In addition to profuse harmorrhages in the skin and from purcous surfaces there we a marked decrease in the platefasts and normal congulation time and a proboged bleeding time. Shelling also reported a delayed contractility of the nometractile cloth and a postitive constructor test. The 2 cases were all females a were children 2 and 7 years of age and one o years old. The cases were reported as thomotopytopenic purpour. Snelling advocates spheractiony as bring useful in the treatment of ido-nather purpour when transfusion of blood and of nake verom fair.

Dutton (1938), in reporting a case of thrombocytopenia with symp toms resembling a mild case of onyalai thought that a dietetic origin should be looked for in such cases and that a milder treatment than splenectomy should be advocated Thrombocytopenic purpura has also been reported by Source and Madison, which it is suggested was probably due to food allergy In Dutton's case the allergic symptoms appeared to be due to citrus fruits and when these were excluded no fresh spots were seen and the old ones cleared up completely in 10 days The blood platelets had been as low as 60 000 per cmm but after this treatment the platelet count rose to 240 000 When small amounts of citrus fruits were cautiously added to the diet fresh ecchymoses appeared in a days In serious cases blood transfusion or autohaemotherapy should be employed

In symptomat c thrombocytopen a the effect is probably due either to (1) the hone marrow or (a) to the spleen. In both cases capillary endothelial damage by toxins and anoxaemia poor nutrition and other unknown factors may play an important part The towns of acute stages of certain fevers as well as certain ingested poisons may have a district action on the megakary ocytes and so reduce the platelets produced. How closely onyalar is related to other forms of th ombocytopenia is not entirely clear

Broch (1942) has reported a case of a 27 year old woman who was admitted to the hosp tal with thromhopenic purpura after taking quinidine for a period of 14 days During the p ecced g half year she had taken quinidine for 4-5 weeks without having

the slightest trouble

Definite thromhopenia without any other basmatologic symptoms and without morphologic changes of the megakaryocytes in the sternal marrow was experimentally p oduced several t mes by administering o 40 grams of quinidine sulphate per os Durn g the course of an hour the numb I of thrombocytes sank to about one fifth of their normal value. The lowest alue was attained after five hours. The or ginal values were approximately reached after 48 hours.

Broch bel eves that in essent al thrombopen a the dec ease in the number of blood platelets is brought about by the reticulo endothelial system but the details of the mechan sm are as yet unknown He thinks that in allergic thromhopenia the mecha n sm is similar all o that no actual destruct on of the blood pl telets occurs but that they a c only tempora ly with held from the circulation and that the reticulo endo thelial system plays a decisive role in the proces

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VITILIGO (LEUCODERMA)

This disease of the skin is very prevalent in many parts of the tropics It is not only more frequent in the dark skinned races generally than in the Caucasian races but is particularly frequent in the negro Apart from this idiopathic acquired form perhaps influenced by heredity and con sanguinity of parentage other forms of achromia with depigmented areas of skin relatively complete are also common in the tropics. Such depigmentation is sometimes observed in the skin lesions of leprosy or or leucocytes but in fatal cases naturally there was a severe drop in the former the color index varied from 0 85 to 0 98 in those who recovered

The bleeding time was prolonged in his cases but the coagulation time showed fittle if any departure from the normal. The chief characteristic was marked reduction and almost complete absence of platelets. In 2 cases examined megakaryocytes were present in normal numbers in the bone marrow and there would therefore seem to he an inhibition of the normal maturation of platelets.

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Dutton (1938) in reporting a case of thrombocytopenia with symp toms resembling a mild case of onyalai thought that a dietetic origin areas there was slight scal og. On the palms and in the folks and about the joints there was more scaling and exfolkation of the horny layer and pitting of the surface of the skin. Scripings from the skin examined in potassium hydroide solution showed so myeckin as optors of fungs. In attaced preparations of strapings made from the skin the same result was obtained. Histological study of actions of skin from this case all o show that the process is one of true vittiges and that no fungs are present. In fact the sections show no pathological changes with the exception of the absence of pigment. There is not only loss of pigment in all the chromophores but also the whole area of skin in the affected patch takes a much piler stam in comparison with the normal skin seen at the edge of the tissue. Very few pigment-containine wandering cell are present in the contem. There is nothing from the microscopical or histological study to sugg st that the affection is parasitic or infectious in its ongo.

In the study of other cases blewise the only pathological change found was the absence of melanin and of melanoblasts with sometimes an excessive amount of pigment at the margins of the white patches

A form of valage a high may follow areas of prolonged infection with microporon furfur infection is sometimes encountered and has been called attention to in Africa by Shattick, and in the United States by Julies (1934). The depignmentation to in Africa by Shattick, and in the United States by Julies (1934). The depignmentation which occur in prais and yaws is discussed in Chapter VIII. Lesso ferms in temperate chinates and yaws is discussed in Chapter VIII. Lesso ferms in temperate chinates paths from its united on the Proceedings of the Chapter VIII. The Chapter VIII is a substantial to the chinates and the chinates are the chinates are the chinates and the chinates are the c

In a few instances in which only a single patch has developed recovery many in time occur. However in cases of a few years tanding there is apparently almost permanent loss of function of the melanoblasts

Treatment—It has generally been found that no treatment is of any axal. However Panja and Maplestone (1920) have used the oil extracted from the seeds of Parodia arojtyloia known as bouchi oil by intradermal injection and have reported excellent results. In a or 3 weeks, pigment began to form. The white patches may be made less noticeable by the dilute solution of walnut junce or by painting with permanganate of potash solution (6 ~~ 5 per cent) in water. If the borders show hyper pigmentation these may be bleached with strong hydrogen peroude solution.

VITILIGO REFERENCE

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ALBINISM

Albunism is not uncommon particularly among the African tribes in the interior. The individuals usually have a drity white transparent skin and yellow or yellowish white or reddish white has. These patients usually appeared to be in poor physical condition apathetic and afflicted with photophobia and nystagmus such cases of albunismus uni ersolis are usually regarded as congenital

There is apparently a complete failure of the basal cells in oxidizing and storing melanin. Since the subjects are extremely susceptible to

of syphilis and in the scars of treponemiasis It also occurs in pinta and has been reported in yaws

In idiopathic vitiligo any part of the body may be affected, including the muco cutaneous areas though the extensor surfaces of the hands the face, trunk and legs are sites of prediction Often the disturbance is symmetrical. The affection usually begins insidiously as a small depaymented spot which may be diffuse or sharply circumscribed. The spots extend peripherally increasing in number and usually coalesce. Usually the affection progresses slowly but in some cases it is so rapid that the greater portion of the limb the trunk or the face, may become white in the course of a few months.

The hair of the affected parts may also become white.

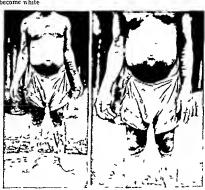


Fig 244 -Vitiligo African nat ve (Harvard African Report 1930)

Choper who has found the affection very common in India notes 4 chincal types (i) affects the palms and soles only (2) mucocutaneous type affects the hps and angles of the mouth the cycled's the annu or prepuce and the vulva (3) only affecting the presure area about the waist where the loss offsh is worn by Indians (4) a generalized type In a case here illustrated in a native African there were wodepread pinksh white

patches on the hands and to a less degree on the feet. The palms and heef were also mattered green that the largest I some esteaded along the man rule of the ruph arm from the palm meanly to the elbow. There were small department patch entering the control the largest white areas and scattered over the body. A patch on the lumediate position of the mucous membrane of the hup and of the gum. The skin of the back appeared armain in every respect save color. In the department of areas on the forearm the skin was of normal texture to the skin seemed to be that cheed and of abnormal texture. In some

lying shu so that they had a muchown like appearance. The d ameter of the tumors varied from about 5 mm to 15 mm or some 5 mone of them had condexed to form tregul r masses. They were all sharply crummenhed but some circular white others were irregular moutine. Retraction of the aveidings in the best of the following hydrodized a contracture so that the right arm was best and fixed at an acrite a eight. The lastice is also that the right arm was best and stored at an acrite a eight. The backs are the source of the retraction of

Some of the nobiles showed pitted scan and others more extensive scar formation in the centre but the smaller nobiles exhibited lattle own acarming. Some of the larger ones were covered by areas of normal skin while over many of the other swellings the skin was tense sharp and translucent in appearant. The color of the skin was not skin was tense sharp and translucent in appearant extra the color of the skin was not materially altered but there was a lack of normal elasticity. The consistency was firm to hard not some of the large andings pitted very leightly on pressure. A watery secretion enuded from a crevace in one of the swellings and enother crevite was crusted. The skin sensition was appearably appearably normal. The lymphatic glands were not enlarged. Extraon of portion of a nobule from the back caused pass but one extract from an overlanger edge of another known caused from the back caused pass but one extract

P cets of insue excued from one of the larger tumors were found to be of fourth consistency and radinous white appearance while the smaller tumor was of softer consistency and of a pale now time typos section. The tissues were hardened in Zenker a solution and in formalia. Filin preparations made at the time from the cut section of which the consistency of the consistency

The sections from the tumners of this case were staned in hatmatoxylin cosm. G emas a solution Mallory's conjective tissue stain and Levachit s silver impregnation method. A hatchological study of the 4 pieces of tissue removed, showed that the legislations which he beneath the epidermis are composed almost entirely of fibrous connective tussue. However there were shifty variations observed in the different tumors and

al o in different parts of the sections of the same tumor

Some of the waving connective tissue fibers were so thack as to resemble in use in crofisiane. No elistic fibers could be distinguished in these areas which is in marked contrast to what is usually observed in ordinary cutaneous sear tissue. In other places the tissue was not a long spandle notice and the growth otherwise con sixtle of dense fibrous tissue while no still other areas the fibroglia fibrils were distinuted in this first disched was the sections at a most marked between layers of bands of the coarser collagen fibers. These peratanees were especially marked in the sections stanned by Mallory's connective tissue stain. There were good numbers of blood verside which the tumors and in many areas there was slight infiltration and productations of the cells about them. However the surrounding beam for range and on anallel and the infiltration did not extend into the surrounding beam for range and on anallel and the filtration of for extend into early free from infiltr to myth cells. The prod fraction of the theololasts was a much more six is gleature than the productation of the waxular dothelium. On the whole the tissues showed a marked regenerative process on the part of the fibroblasts with 1 title or no endothed in of lymphocytic millitration.

The explanation for the marked tendency toward keloid growths among many African tribes is difficult

Sometimes an bereditary pre disposition has been observed.

Justus beheves there is some relationsh p between hyperthyreosis and keloid forma tion while Payr beheves that individe is with hypopl site constitutions are especially predisposed to their formation in fact to such connective tissue formation in general 1138 KELOID

sunlight and suffer from chronic solar dermatitis on the exposed parts they should be kept away from the strong sunlight as much as possible

A mild degree of the condition which has been observed in India some times results in a spotted skin, or actual piebaldism but the condition may improve with the attainment of maturity, especially in the case of women after childbirth

No form of treatment has been found efficacious although an especially nutritious diet has been recommended by Chopra

LELOID

This term has been applied to an hypertrophy of the fibrous tissues particularly in the cellular layers of the corium. Under usual conditions



Fig 240 - Keloid African native

in the formation of scars the fibrotic process becomes arrested apparently by the strangulation or obliteration of the newly formed blood vessels especially through contraction in the bealing wound and there are left roote or less pigmented or deponented clastic scars which remain However if the development of newly formed blood vessels continues and there is an abnormal resporse of the angioblasty the growth of fibrour instance and continue giving rise to hard overgrowths of issue which become raised above the surface of the skin and may extend well beyond the original site of the nipury. In many such instances the epiderms over the keloid growth then becomes thin from pressure and the growth may have a smooth, glossy appearance. Sometimes there is considerable byperaesthesia or actual neuritic pain owing to involvement of the sensory nerves. The growth as a rolle takes place slowly and the lesions vary a good deall in size and distribution. Those occurring after hurns or scalib are often extensive and may lead to contractures and disfigurement They rarely involute spontaneously

In the case illustrated the lessors consisted of large keloid like nodular a rellings on the sides of the neck face thest breasts shoulders back arms legs and fanks. They were elevated from 0 5 to 1 5 cm above the surrounding skin and the edges of some of them particularly upon the back bulged and spread out slightly over the under primary cause of the d sturbance however no ov dence of a fungus was discovered. Nevertheless they suggest endermophytosis (athlete's foot) as the most likely infection to cause bilateral less ons in the cleft of the little toes. The observation that selerotic narrowing of the arter es nass hisent in the right toe and advanced in the left suggested that it was secondary to the lath lesson which was also more severe on the left and

Symphomatology and Treatment—In 90 per cent of the cases the lattle toe is the one affected more rarely the 4th toe or very rarely both the 4th and fattle toe. The lattle toes may be attacked at the same time but the condition usually first starts in one toe. At first there is a crack in the dipto plantar fold of the lattle toe. This extends laterally and finally appears on the dorsum. The distal portion of the toe enlarges and becomes bulbous so that it looks the a small potato. The connection better en the foot and the bloated looking toe is a lump fibrous cord which permits the toe to wabble in various directions and to unterfere greatly with walking.





Fig 46 — Ainh m (O w ld Cru In t tut ph t gr ph)

A nhum R nig n g m of adjoining Fig (O waldo Cru In t tute)

The course of the disease extends over several years of the toe is not amputated by cutting through the fibrous pedicle or as the result of ulceration from injury to the pedicle. There is little or no pain of the affected toe or toes probably connected with loss of sensation

Big Hill—Mackan observed in nat: es of the Gold Coast in hypertrophy of the to ocales. Mawved lake described a sundar cond to no Formous. It has been is greated that the condition may be similar to that which invol es the superior manillary bones in Gondon (see Chap X Lia do Appenday p 577). Big helis said to begin rather underly with fe er pa n and tenderness followed by swelling and enlargement of the ocales of one or of both heles.

Chuyd (Kany mha) — Under these terms Manson referred to a form of acute rectuit which as reported from South America and later by Gildes in Northern Rhodens in valleys at an altitude of 2000–1900 feet. Recently it has again been called attention to in Africa. Manson Bahr (age) describes the cond tons with underso ast and an acute course the primary manifestat on being a white powdery condition appearing about the annia and groung the appearance of the control of the valuation of the control of the valuation of the control of the valuation of valuation of the valuation of valuat

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Davies J N Pand Hewer T F Ainham Rep tof a Case in En land with Hist log cal Study T on R y Sec of T p M d & Hyg 35 Sept 94

Son g E W Ainhum its occu ence in the United State with a report of three cases Ame J R st 42 246 939

1140 AIVHUM

such as the production of adhesions Menes however thinks that scrofula and syphilis predispose to keloids

None of these explanations except hereditary and racial tendences seem to be particularly applicable to the frequent occurrence of the condition among certain African peoples Keloids frequently develop at the time of puberty or in the years immediately following

Treatment with \(\) rays has been recommended in which however severe reactions should be avoided and moderate applications given over a longer period of time \(\) For small kelods repeated refigerations with carbon dioxide snow have been employed Macleod has shown the use of radium to be most effective He recommends a full strength radium plate which is screened off by a silver plate r mm in thickness. He says the exposure should be one of rs-30 hours are often recallettant to treatment.

Excision is generally not advised although Chopra thinks that in some cases very resistant to X-ray and radium that a plastic operation with skin graiting may be the best remedy. The result after surgical operation depends especially upon the inherent tendency to reproduce keloid growths

AINHUM

This disease equivalent clinically to a spontaneous amputation of the little toe has been chiefly noted in the natives of the West Coast of Africa especially among the Kroonen and in Brazil. The writer found it common in Liberia, where it might be unlateral or hilateral and occa sionally caused the loss of the 4th toe as well as the 9th. Cases have been reported from the West Indies and rarely from the Southern States of the United States It does not attack, white people and the susceptibility of black races is probably connected with their tendency to keloid development. There is some evidence of anishm being a familial disease as it sometimes seems to select members of the same family or generations of the same family.

There have been all sorts of suggestions as to ethology (a) that it is related to leprosy (b) that it is a tropho neurosis (c) that it results from wearing constricting bands or nings on the toe (d) that it is connected with frequent injuries to the under surface of the little toe

Pathologically there is often found a fibrous cord which has replaced the bony structures normally attaching the toto to the food According to Unna there as a ring form seleroderman with thickening of the epidermus causing an endartenit with the production of a rarefying settint. The disease is chiefly found in make adults between 25 and 30 years of age. Castellam who has observed similar changes to Unna about 50 points out that the constant mritation causes the epithelium to productare internally and depress the skin and the fibrous connective tissue of the cutts to become ancreased in quantity.

Spring (1939) who has discussed its occurrence in the United States points out its extreme ranty in any but negroes and that the construction of the little too as probably induced by some mechanical or infectious namy and that it predominates in negroes because of the marked fibrogenetic tendency which is so characteristic in some members of this range.

Davies and Hewer (1941) have reported a case in which a histological study was made of the tissues. The authors thought than an epidermophytosis might be the low the intellectual level did not seem to differ materially from that of other natives

While as stated latch has been classed by some authors with the hysteriax Repond disagrees and believes the mentality is not that of hysteric individuals. The subjects are pained at their condition and fight very hard against it. In some respects it has the nature of an obsession or annety neurosis. However apart from their ectokinetic cross they exhibit no tendency to phobas or obsessions and annety is not the usual state of these patients. However there seems to exist a certain state of annous tension readily set free though there does not appear to be any relation between the external executant and the intensity and events of the distress theomeon of latah.

Palthe who has had a wide experience with the disease in Malaya also agrees that it is certainly not a psychosis and still less it hysteric. He thinks a hypersensitiveness for impressions of fright cents in all cases

A condition similar in some respects has been described among the primitive Ainu people and is known as inu. It occurs usually in women and the attacks are precipitated by some emotional shock. They are of a psycho motor character and if one is startled into an attack she will continue to eich everything that it is add to her.

Castella in his study ! latah divided all disturbances into two varieties the impulsive and the must. The former which is produced by sudden shock resulted in violent action or to! gauge of who is the past of might be very much ashamed. The immetries the forms make the besomer of the softern or make the suffern or maket in windstern by surveiling is compiled to imitate. He suggests that latah may be of ely related to the cu i us psychical phe nomena seem at times among differ ent record sufficient people being vanously known in Europe as the jumper the burkers and the prits in distribution that the surveiling that the surveiling that the surveiling the surveiling the surveiling the surveiling the surveiling the surveiling that the surveiling that the surveiling the surveiling

In Madag scar 1803-64 among the people of the lowest classes at the time of the vice that ho the king when sudden to high ware made in the religion and have an othersak cour red which is said to have been ident cal with the dancing manus of the middle ages. There is a strong admixtu e of Malay blood in the natives of Madagascar esocially in the ruine classes.

Unless unusual accidents occur latah is not fatal but it is apparently more or less permanent and it is incurable. However it does not appear to grow progressively worse

Auto suggestion has been advised in treatment

LATAH REFERENCES

Palthe P M Van Wulften Latah Chriscal Te thook of Trop cal Medicine (DeLan en & Lichte stein) Batavi p 5 5 1936 Repond A Au O iental Neurosis S haes Med Wo h 70 148 94

Anrox

Amok is a well known native name in all Malaysian tropics and is applied to a form of homicidal mania which attacks Malays and leads to a blind fury to kill without reason. An individual will suddenly and paparently without reason seize a kins or knife rush from his bouse into

II42 LATAH

PSYCHOPATHIC DISTURBANCES

LATAI

Latah is a peculiar form or manifestation of hyper impressionability it has heen referred to also as a psychosis or neurosis which has been observed in the natives of the Philippines the Malay Pennsula Java, and the surrounding islands. It occurs in both sees somewhat more often in women, but children are rarely affected. It is apparently confined to the Malay Race. Patthe (1936) described it as a peculiar reaction to fright, in which the most striking symptoms are a clouding of conscious ness echolalia, and echopravia.

In Batavas he writes a woman is called latah when by giving her a finght it is possible to throw her into such a conditione that she repeats the words spoken to her with
the intention that she shall do so and mattest all actions performed before her with
the purpose that she shall matted them. In order to precipitate an attick in individual
subject to latah it is usually only accessary to suddenly siturat their attention or starde
them as by a sudden shout or cry or blow and at the same time by pointing suddenly
them as by a sudden shout or cry or blow and at the same time by pointing suddenly
them as by a sudden shout or cry or blow and at the same time by pointing suddenly
them as by a sudden shout or cry or blow and at the same time by pointing suddenly
them as the subject of the sudden should be sufficiently to the sudden should be sufficiently
to the suddenly fragisted be sufficiently to support the state the victim is at the mercy of his prompter and he will involuntably
follow him blindly and yield to any of his comments or suggestions. Sometimes when
the midwidual is suddenly fragistend he sull fall follow in an attempt to imitate the move
ments and gestures of any people who may be in asplit

Usually some of the relatives or nearbhors recovant the tendency in ose of their

number to suffer from attacks of latah and concetimes they call the attention of the physician to the condition as the subjects otherwise often appear to be normal mentally and physically. In other cases the discovery of the condition by the physician may be

an accident

Such individuals are often made the subject of practical lokes. They however usually are aware that they are being made fun of and greatly resent it and become angry

and otten economic.

Faithe states that it is certainly not a psychosis and still less is it a form of hystena.

Those who are afflicted with it be says are otherwise mentally sound and can maintain their social position in their natural walk of hie perfectly well in spite of the teasing to which they are often subjected.

When the attack has been started, the patient remains in the condition as long as the examiner or director occupies bimself with the individual. At times the patient will frequently begin the attack with an ejaculation of some obscene or meaningless word. If the patient is left alone, or talked with in a quiet calming way, the condition usually subsides and the patient again behaves like a perfectly normal person

In severe cases following performances requiring much physical activity, the individuals may show signs of exhaustion or of swooning

which may end the time of the hypnotic like attack

Repond (1940) has made physical evaminations of 9 patients which did not reveal any defect. All seemed to be in excellent general health nor could he detect any sign of mental disorder such as for example schizophrema. While the general mental state on an average was fairly

recognized and in certain instances fully expected by the person involved and his neighbors. He points out that it is a preformed reaction method that her seady to hand in which there is a certain ritual as it were every phase being standardized. He has never known of a single case of amoliamong the many. Malays who have gone to hie in Europe. He importantly points out that the surroundings and sphere of influence in which the individual hies within the Malaysian land where the condition occurs has a definite influence on the Irequency of amoliand gives as an example that in the old hospital in Batavia with its typical primitive native atmosphere amolians and its common. However when the patients were transferred in 1914 to an imposing modern hospital with up to date equipment where every thing was conducted on European lines and where an entirely different tone was maintained from that moment amok among the patients seased.

The results in the Philippine Islands have been somewhat similar Hers ands, has heen very largely observed among the More tribes that inhabit Jolo. The Mores of the Philippines were finatical Mohammedans and had adheed to the belief that there is no God but Allah. In the early days of occupation of the Islands by the United States amok was very common and numbers of officers and enlisted men as well as civilians lost their lives in these sudden furnous attacks which were so frequent From a study of the subject it appeared that in a number of instances such attacks had followed exhortstatons by the priests or visits to them shortly or immediately before. Through punishment of these Moham median priests the disarmament of the Mores and especially through their general education and through the training in the Christian More school established by the late Bishop Brent such attacks began sensibly to dimminsh.

Especially throw h this school there was bought to these neglected people the sesets of a new civil attou which raised their standards of thir g and through leading better lives their religious social and moral views were changed. So great has been the change among these people within 25 years that amok is no longer a menace there and indeed one seldom hears of it in this Sociality.

LORO

A form of anxiety neurous described in most text books of tropical diseases has been termed koro. This peculiar phobia has been described as appearing particularly among the Buginese and Mucassarans in the Celebes and in West Borneo. It also occurs among the Chinese and is known by the term. Shook year.

The condition has been described by Falth, as an awardy state in which the p tent is nettered that be spem and lish out how he big and that has a result of this he will dee This annetty comes on suddealy its very intense and a metimes may last for several days on end. In order to pe vent the occurrence that ha so greatly details the patient holds onto his organ with a wee his grap and is helped herein by his wife friends and relative who star around him in a crude. They must all set to it that the pens is not relative who star around him in a crude. They must all set to it that the pens is not after the order of the sample instant otherwise in its about and de this follows inevitably! After the contraction of very law has a stated gradually wears off but it is repeated again.

1144 AMOK

the street and slash and cut and stab at everybody he meets until he is overpowered or killed or kills himself

Not infrequently in an incredibly short time he will with marvelous skill deal deadly stabs killing or leaving desperately wounded on the ground 5 or 6 or even more people In his lust and behaving somewhat like a mad dog he attacks not only man but animals such as the carabao (water buffalo) which may come in his path making huge slashes in their sides. The neighbors with wild cries of Amok amok seek safety in rapid flight. Usurlly he is shot down by arriving police or constabilizing and if this does not come speedily when there is no one in sight to kill he may turn his spirit to destroy upon himself and self inflict terrible wounds such as cutting his throat or laying his abdomen widely open. In other instances, he swoons into a stuporous con dition and has afterward no memory of what has happened However more often be does not become satisfed and does not stop of his own volution. This is generally well known in the neighborhood and for this reason he is generally quickly shot or killed in another way so that as a rule a psychical examination cannot be obtained

Hence for a long time the reason for such aggressive brain storms has not been clear and even now a number of observers do not think that an entirely satisfactory explanation can be given. These frenzies were formerly regarded as due to sudden insanity. Others suggested that a typical attack might be the result of circumstances such as domestic jealousy or gambling losses which render a Malay desperate and wear) of his life and that hence it might be equivalent to a form of suicide

Van Loom thought the attacks might be a specific reaction of the Malay race to toxic influences of the central nervous system the result of attacks of fever caused by malana pneumonia or syphilis However this idea has not been supported in recent years, since the attack bas been unmistakably observed to occur in subjects which were otherwise perfectly normal both physically and mentally Rather did the attacks appear to be the result of psychic influences and to occur in individuals which felt themselves violently offended or who were in serious trouble from which there seemed no outlet

Palthe (1936) who has especially studied the coodition in the Dutch East Indies points out that an unsupportable conflict may develop in such individuals in which after a period of meditation there is an emotional overflow of his entire consciousness which discharges itself in an aggressive brainstoem. In cases in which the individual has come through the attacks still alive he has found no psychic abnormality except a complete amnesia of the occurrence

Van Loom has pointed out that anxiety is an element that is never absent in amok He thinks that the individual gives the impression of a cornered rat which strives to defend itself as best it may by making a savage and reckless attack on whatever may be in front of it Several investigators have found that the individual may prepare him self so to speak for his actions during a period of meditation and the monotonous muttering of Loran texts with rhythmical swaying of the body and with dulling and narrowing of consciousness Castellam also thought that the exciting cause was a strong emotion following anger sorrow or hate and that if the individual recovered there was a period of depression lasting days or weeks during which the patient broads over his wrong. Miall thought that the attacks were sometimes due to smoking In the Dutch East Iodies 11 has been said to sometimes follow opium smoking

Palthe regards it as being a standardized form of emotional explosion which is recognized in Malayan countries, a sort of beaten track, well

SECTION VI

DISEASES DUE TO FUNGI POISONOUS PLANTS

Chapter XLI FINGI

Classification -The funga belong to a group of plants known as Thallophyta They are filamentous plants which do not develop a com plex body and do not produce root stem or leaf. There are two large subdivisions of the Thallophyta algae containing chlorophyl and funga ceae lacking chlorophyl The fungaceae include the fungi of which three large groups may be recognized

() Sehizomy cetes or bacteria

(2) Eumycetes or true fung: which may be defined as unicellular or multicellular plant like organisms usually larger than bacteria with definite cell walls which mult ply by cell fiss on budding and usually by means of asexual and se ual spores This group contains the pathogenic fungi

(3) My omycetes or slime moulds are multinueleated naked masses of proto plasm (Plasmod a) Some of these o ganisms may be protozoa. No species is patho

genie for man

The subdivision of the fungi presents innumerable difficulties and there is great lack of harmony in the different botanical classifications as well as in the classification into chinical and pathological groups. Indeed it should be emphasized that the classification of the fungi is still in a con fused condition and that the botamical groupings are in many instances obscure

C W Dodge has prepared and published a notable contribution upon the subject of medical mycology and it is the most complete one that has been published in the United States It constitutes an admirable docu mentation and catalogue of the descriptions of the majority of the species which have been described as parasites in man or mammals and it con tains also an excellent and very rich bibliography. The work however has not been prepared from the critical point of view especially in regard to synonomy Thus Langeron and Guerra (1938) point out that a single species well characterized and easy to recognize by its chlamydospores Candida albicans is found dispersed among to genera and naturally 1147

1146 KORO

If there is no help at hand it is reported that he may actually tie the pens to his leg with string and anchor it by means of a pin frequently employing a double bladed clasping instrument used by jewelers and known as he teng hok

According to the native explanation of the affection the Yin principle representing the female power dominates the Yang principle which represents the male element. In order that the Yin disease may be cured a Yang medicine must be

employed

The afflicted individuals are usually neurotics and the annexty is and to arise out of sexual conflict. Freud has suggested the conflicts in some instance may be related to the fear of castration which in China has generally included amputation of the petus as well as the testes. Koro and other degenerative forms of neurosis have been esteroilly discussed by Wong Wu (History of Chueses Medicine Thentisin 1933) and P M Patthe (Clinical Text Book of Tropical Medicine DeLangeri & Lichtenstein Batavia 1936).

FUNGI 1140

Morphology and Biology -Two classes of thallophytes are especially of medical interest the Ascomycetes and the Hyphomycetes or Fungi Imperfect: A third class the Phycomycetes have only been reported from man in a few instances The two latter not infrequently contaminate bacterial cultures

Fung: like bacteria do not contain chlorophyll hence they must live a saprophytic or parasitic existence In their simplest form they consist of ramifying filaments called hyphae A network made up of vegetative hyphae intertwined in tangled threads is termed the mycelium. Growth may be either by addition of new hyphae (apical growth) or by di is on in a single hypha (intercalary growth) The hypha may be a single cell or many cells separated by septa

Some hyphae contain cellulose others chitin In some fungi the mycelium becomes packed as hard masses containing food material to acrye future germination and known

as sclerotia

Probably only in the case of P drain ho to (causing a disease of the hair) are such structures present in pathogenic lungs but in the mycetomas the granules are of this nature and known as hullil Ergot is the sclerotium of a fungus (Cla c ps pu pu ca) attacking the grain hearing heads of the and is of importance med cinally and as a food po son. In the M ddle Ages there were great epidemics of ergotism causing gangrene (St Anthony s fire)

Spores.-Equally important in structure with the byphae a c the spores (conidia) A spore may be simply defined as a cell which may or may not separate from the hypha but which is capable of germin t ng and reproducing the parent cell or hypha. A spore may he non sexually produced by simple separation f om the hypha (conidium) devel opment along the cou se of the hypha (oldium or chlamydospo e) or within the proto plasm of the hypha (endospore) The te m chlamydospore usually implies a rather thick walled are al spore which is capable of rensting an unfavorable environment and subsequently germinating. Hyphae m y separate from parent hyphae and form arthrospores (thallospores) which may subsequently become oval or round (hlast spores) Blastospores characteristically aprout from byphae

Certain fungi have hyphae which fo m fru ti g branches called conidiophores (sporoph res) When cells a ep a na which give rise to e dogenous spores (sporangia) the sporophore is called a sporangiophore

The class Asc mycetes is characterized by the ascus a sporangium in which spores d velop usually to form 8 ascospores

Where rep oduction is of a sexual type the gametes (sexu i cells) may be equal or unequal or the female g mete may be much large than the male one (sperm) the latter fertilizing the egg which later produces oospores Parthenogenesia is frequently present among fungi

Mycoses -D seases caused by fungs are known as mycoses The terminology of the mycoses varies considerably with different authors but fairly well recognized terms are the dermatomycose or rangworm affections otomyco s onychomycoses and maduromycoses Again the name f the affection m y be taken from the fungus con cerned in the cause as sporotr chosis blastomycos s actinomycos s or aspergillosis However there is also I equently great divergency of opin on in such class fication Thus Brumpt (1036) under the term Blastomycoses includes only the diseases produced by the b dding fung: (Saccharomyces Myc torula and Torul) or those p e senting the f rm of ye sts (blastospores) and be definitely e cl des the o ranisms produced by the non building fungi. However many other authors and de in this term disc es caused by fungi not only of the genus Saccha omvers but of Cryptoco cu Coccid od Oidium and Monit a (Candida)

Pleomorphism —The fungi frequently reveal rem rhable variations in pure cultures and this a particularly found in the species which cause ringworm. Thus the morph ology of the periph ry of a dermstophyte in y be entirely different from the original centr 1 no ulation growth and the change may hold for subcultures from the per pheral under different names Several other species are described in 7 different genera while the genus Candida he subdivides into 13 genera contai ing 12 species Castellani in his classification has on a number of occasion-described the same fungus under a number of different names. Such examples emphasure the difficulties in classification.



(Trichosporum gigonicum) Another species has been reported from British Gunna and from Brazil P horfus and Souchard 1937 has found this species in cases in Cochin China. Horfu has published an excellent monograph regarding the condition. If an infected hair is examined in bluque potasses the nodule will be found to be made up of facetted bothes matted to the side of or at times encircling the hair but not invading it. The fungus grows on Sabouraud's medium but better on carrot. A form of Trichonocardiasis similar to piedra has been reported by Chalmers and caused by a species of Nocardia (actinomyces). Infections involving either the hairs of the bead or bearded regions have a wide distribution

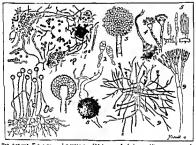


Fig 247-1 Thave Irscrapng (MIss of f) 2 Altred 3
Asperglis SF sum 6 7 8 M cor 9 9 Pn ll m

according to MacLeod Lampe (1940) reports that piedra with black nodules caused by Piedraia is frequently met with in the native population of Batavia

Manson Bahr (1990) als complains as that tracho powers must not be confounded with Trackonsysses of a to Theomorecutasian when is a fungue of ease of the harr and common enough in the a library so total and face hair in Eu. p. and elewhere Also it should not be confounded with is interest used of a non prastic disease of the three confounded in the confounded and the confounded in the confounded in the three cases of the confounded in the confounded in the confounded in the three cases of the confounded in the confounded in the confounded in the confounded three cases of the confounded in the confou

Tricomycosis has been reported in Central Africa and Asia and Japan as well as in Europe Casals (1939) has reported cases of trichonocardiasis in Cuba. In some respects the condition resembles piedra. The shafts of the hairs especially those of the anils are said to be attacked. The

1150 PIEDRA

sone. Also different spore forms may develop from the same culture. This is usually referred to as pleomorphism, but the term polymorphism is wrone applicable to many of these variations. It is well recognized that variations may result from culture motion ment—hence the necessity for standardization of composition temperature and reaction of culture media used in research. (Seep 119.2). The terms altitation has been employed to indicate variation in morphology in the fungus in different parts of the colory Statistion should not be conflosed with mutistion as the two may only the identity of the colory Statistion should not be conflosed with mutistion as the two may only the identity.

PHYCOMYCETES

The phycomyetets are sometimes referred to as Lower Fungs as they approach more the primitive forms. The Accompeters and Upphonevertes are classified in the forum of Higher Fungs. The Phycomyetes are not usually regarded as of great superties in human particularly. However, the Pumps and Ramphotton have classified turn during that fungs. Risinstructions seeker a and Coccalender summirs under the Churchalles as order of Phycomystets (see In 12). Here existed as Account to the Churchalles as order of Phycomystets (see In 12). Here existed as Account to the Churchalles as

Otherwise it is only necessary to consider the Mucoraccae which are moulds so often observed as cotton like areas on decaying foodstuffs or as Petri dish contaminates. The best known species is **Iweo** mixed* so common on horse doing but it is now denied that this fungus plays any part in human mycoses although a case of mutor kerstomy coasts has been reported where this common mould was stockled from a corneal lesson and the stockled of the

Absidia corymbidera (Mucor corymbidera) —The sporangum of this lungus aver ages from 30 to 70µ in diameter with smaller ones from 10 to 20µ. The spores are sphered and measure from 3 to 4µ in dameter. It grows well on Sabournud a medium. This spoces has been reported in a number of instances as the cause of nasal pall monary and aurodiar mycoses. Blumont 1003 to

Rh 20048.—Two species of this genus R sieve and R portaining have been regarded as possibly partiogence. The former was soluted from rate cases of black togge and the latter from the sputum of a case diagnosed as pulmonary mycosa. Vulleration and others doubt the relationship to black togges which is now regarded as a symbol of a vitamin deficiency. The columnia of R may a site the debisence of the sportan guing in multiposm shaped. The software has mature base a black toolor.

ASCOMYCETES

Among the Higher Funga are included the classes Assomments and Funga Imperfect
the Astomycetes are probably the mot definitely characterized of the tingut histobiavang a special type of sporangium called an accus (little sac). In the young assous
there is a single nucleus which by a successive deviasions frequently results in Sund
clatted ascomports. However in some forms only 2 or 4 ascomports may result—or
even 16 may occur.

The yeasts which reproduce typically by budding but produce also porce are included in this clais. Other budding forms may fail to show ascespore formation (asportogenous yeasts). In some Ascompretes there is a well developed thallus with sepirate hypikae (the hypikae of Phycomycetts are non septate). In the yeasts only a spotent mycellum as known.

Piedra (Trichosporosis) —This is a fungus disease of the hairs in which small nodules form along the shaft. They are about the size of the ints of head hee but more or less surround the hair instead of projecting off at an angle as do the ovoid lice nits. The small sandy concretions are black in color and very hard beace the name pedra—stone. The disease was observed frequently in Colombia in women and the infection was thought to be due to the application of a muchapious preparation to their hair. It also occurs upon the hair of the beard. The stone like concertions are caused frequently by the species Profrais columbiane.

endospores and having a thick, doubly contoured capsule. These rounded elements never show budding in issues. Cultures of the organism on artificial media develop creany white colomes appearing in 4 to 17 days on malt extract agar later becoming cottony and brown with abundance of chlamydospores (4 to 7 a). The hyphae are about 3 \(\mu\) wide. MacNeal and Taylor have noted endospore formation in anaerobic cultures. I mocu lation of monkeys rabbits guinea pigs and mice with cultures give rise to the same cyst like structures with endogenous spores as noted in human tissues.

By the end of 1935 more than 400 cases of the affection had been reported with 80 per cent of the cases in the United States from California where the disease is reportable. Scattered cases occurred in other states Dickson (1938) has reported upon valley fever or desert fever of the San Joaquim Valley as an acute coccidiodal infection. The Iessons of the skin resembled crythema nodosum and there was usually pulmonary involvement. He thought that the infection was caused by inhalation of the chlamydospores. A great majority of the cases promptly recovered Brumpt has described a species C histopheroicilisors is at he cause in certain Brazilian cases and Dodge motes the desarabitity of further comparison of the organisms found in Argentina and the United States Coccidiodal granuloma has also been reported from Meuco Uruguay and Argentine.

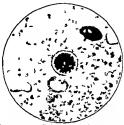
A form known as paracycer d osdał granuloma has been found especi lly in Brazil a di un swemi other parts of South Amenica. Several species of Paracsecia of a f ha is been deschoed as the cause. Moore (1938) has reported that a generalized form of the disease may be due enther to the specie or 30 ac as d and a few laters or to P lenute and that a because from involving the buccal muccons is due to P cereb-from z. Rosandeld that the state of the flower of the state of t

Moore has class feel pe accreationder in his family Occase a deacese. Comain and Howell (1441) who have companied a number of strains of blastomyces solidate in north America with a number of strains of blastomyces solidate in sort America with a number of strains of Paraesce di sel a solitated in South America the source not given find that it by differ only algotylary in cultural appects and more than the source not great the source of the source of the solitate of the so

Coccidence, costs may start as a skin affection or first may become manifest as a pulmonary lesson. From either attrum on infection gen eralization may follow. The skin lessons may be nodular ulcerative papillomatous or verviews. They often resemble those of tuberculosis with the presence of cold abscesses. The fungs occur either isolated or in guant cells. It is this tendency to metastass through blood and lymph channels that explains the seriousness of the disease. The differentiation from tuberculous syphilis and other funguis infections is made by finding the non budding cysts with endospore formation. A wet preparation is entirely satisfactors for examination.

Complement fivation reactions with antigens prepared from cultures of the infecting organism have been obtained but the reactions are not

species studied by Vullemia was named Trichosporon biegoli. The fungus may be easily cultivated by moculating the nodosities on Sabouraud's medium. In culture mycelial growth occurs composed of arthrospores giving rise to blastospores, and in older cultures to ascospores. Cases have been reported in which the beard and mustache have also been attacked and in which they were matted together so that they could not combed. Manson Bahr reported a case in which the hairs in the affected part had a beaded and nodular appearance and the hair emitted a peculiar odor. Microscopically, the polygonal cells were yellowish green or brown in color. The infection may extend to the skin and cause a severe intertries.



Fio 248 - Coccidio des imm les Endogenous aporulation n center (Court sy of Commander II E R gle Med cal Corps U S Navy)

Treatment —Sutton and Sutton (1939) recommend that the har should first be sponged with benzine to remot call the gritty particles Chalmers reported excellent results by applying to the affected hairs a 2 per cent formalin solution in alcohol At might a 2 per cent ontiment of sulphur was applied A 5 per cent alcohole solution of saleptic and has also been recommended Manson Bahr has also obtained success with a similar form of treatment.

Coccidioudal Granuloma (Coccidiomy.cosis) —The disease may occur with vertucous or ulcerature leavins of the sam sometimes with involve ment of the bones joints and viscera. The first case affecting a Brazilian soldier, was reported from Argentina in 1892 by Wernicke Tater his assistant, Posadas made thorough studies of the parasite including animal inoculations. Posadas first regarded the para it as a Coccidioum. The name Coccidioides immitts was later given it by Rusford and Glichnst and the parasite was shown to be a fungus. The first reported case resembled clinically mycosis fungoides. In issues more or less round cyst high structures occur varying from 4 to 894 in dameter containing

endospores and having a thick doubly contoured capsule These rounded elements never show budding in tissues Cultures of the organism on artificial media develop creamy white colonies appearing in 4 to 17 days on malt extract agar later becoming cottony and brown with abundance of chlamydospores (4 to 7µ) The byphae are about 3µ wide MacNeal and Taylor have noted endospore formation in anaerobic cultures Inocu lation of monkeys rabbits guinea pigs and mice with cultures give rise to the same cust like structures with endogenous spores as noted in human tissues

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A form known as paracoccid oxial granuloms has been found especially in Brazil and in several other parts of South America Several species of P r coccid o d s ha e heen described as the cau e Moore (938) has reported that a generalized form of the disease may be due either to the species Paracoccid d s b az li nsis or to P tenus and that a localized form involving the buccal mucosa is due to P cerebriforms Rosenfeld (1940) has found the species b z l casss to be the common one and Inate (1940) ha found this species in Caracas

Moore has class fied Po acoccidioides in his family Coccidioideaceae Conant and Howell (104) who have compared a number of strat a of hiastomyces isolated in north America with a number of strains of Paracoccidender isolated in South America the source not given find that they differ only slightly in cultural aspects and mor phology and a ggest the terminology of Bl st myc s d m tid dis and Blastomyces bro if ns s as they do not consider the differences of generic importance. Other myco logists retain the former in the genus Coccidioides

Coccidiomicosis may start as a skin affection or first may become manifest as a pulmonary lesion. From either atrium of infection gen eralization may follow. The skin lesions may be nodular ulcerative papillomatous or verrucous They often resemble those of tuberculosis with the presence of cold abscesses The fungi occur either isolated or in grant cells It is this tendency to metastasis through blood and lymph channels that explains the seriousness of the disease. The differentiation from tuberculosis syphilis and other fungus infections is made by finding the non budding cysts with endospore formation. A wet preparation is entirely satisfactory for examination

Complement fixation reactions with antigens prepared from cultures of the infecting organism have been obtained, but the reactions are not sufficiently specific to be of diagnostic value. An allergic skin reaction has been described from the injection of such an antigen but it is a question whether it is rehable. Kessel (1930) believes that active cases yield positive intradermal tests, but the question of greatest uncertainty has been with reference to possible cross reactions in cases of tuberculosis Hurwitz, Young and Eddie have reported positive coccidioidal reactions in patients having no known coccidioidal infection.

Smith (1941) has reported that he obtained a positive raction to occolonding recolonable prositions but no reaction to the stringer historynem. In our case of Gulchrus a disease only a moderately positive reaction was obtained with blastomynen and no reaction with occolonding or sportoristicm. He thinks that occidendin is of value in confirming or desyring the presence of the corresponding disease. However Lewis (1941) points out that although coordinoid an appears to dust the prefer reactions it may be of limited diagnostic value in communities where the disease inferime. Farens and Woollige demonstrated that oper cent of school children is a district in California in which occordinoidinnyous is prevalent all give a positive reaction to exceeding showing that the test there would be valueless. In New York low ever where coordinoidinnyous according to Lenn has not been reported no positive reaction was oblassed.

Keesel believes that the sun test can be used as an aid to diagnosis but probably no more relaxore should be placed on at than a usually green the tuberculan test. If thanks that tuberculous patients usually give negative reactions. Nevertheless further acredit studies and confirmation of all this work is necessary before it can be regarded as conclusive. Very little is known as to the source of infection of coccadedid grass infections to a superior of the superior of the superior description of coccadedid grass infections has aggregated the subshabitor of direct payers as the node of inscutation rather than cutaneous entrance from drt of plant material (thorns or prickles). Honever Stewart and Meyer have reported the substant on the furgues from the soil

It has been suggested that rodents may constitute a reservoir of excetandonyessis and Ashburn and Limmons have found that of rog rodents trapped in the desert sound San Carlos Arizona o showed gross pulmonary lesions in prochet mice (Perspinitus) is kapaginor art. In all of the nodular sound superiner (Catellus). Microscopically satisf of 20 nodular sensors were found to the 7 mice and r rat. In all of the nodules the sungue sells were present either in small or in large oumbers.

dugas cens were bresent enther in suitte or til faree ontweers

Stiles and Davis (1942) report an increase in infection of the lower animals not only in wild rodents but dogs cattle and sheep

The outlook is generally unfavorable in the generalized form of the disease and death usually occurs within 3 or 4 years Of 24 cases collected by MacNeal and Taylor only 2 recovered A few patients have recovered

following drainage or excision of local lesions

Treatment is generally unsatisfactory but large doses of potassium todide 20-30 genins 3 times a day well dubted have sometimes been found valuable. Yay treatment has been recommended for the local lesions also the injection of a r 1000 solution of potassium nodide. A few cases have been treated with sulfamiliamide but the results have not been encouraging. In one case with a cerebral lesion death occurred after two months treatment with sulfamiliamide. Storits (1939)

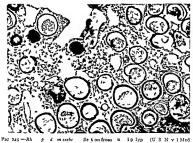
Rhinospondiosis —This is a polypoid affection chiefly involving the mucous membranes of the nose but also invading the ears the lacrymal

sac the uvula and more rarely the mucosa of the penis

Dhayagude (1941) has described a case m a Hindu in which the parasite was found in nodules scattered over the body and there was no nasal or nasalpharyngeal growth

It is caused by a fungus Rhinosporidium seebers which was first reported by Seeber in 1895 in Argentina

It was considered as a coccidat parasite but the work of Ashworth (10 2) proved it to be a fungus and not a protozoon. The organism is found within soft very vascular raspberry like tumor masses which are difficult to remove completely by reason of their finability and tendency to bleed protisely. The youngest forms measure 6 μ and the largest ripe sportangia, soon in diameter they have a thick wall and contain thousands of nucleated spores. The infection has been reported from India Cochin China Uriguay Argentina and the United States. The mode of trans mission is unknown but spores and ripe sportangia may be found in the masal mucus.



Sh 1)

Apparently a closely related organism R equi has been found in nasal cavities of the horse in South Africa

The course of the disease is a long one and there is a marked tendency for it to recur

Satisfactory cultivation of the parasite has apparently not been obtained and the inoculation of animals has not resulted successfully

Treatment—The most satisfactory treatment has been found to be the removal of the polym from the nostrals by means of the wire snare Wright reported that the tumors disappeared after intravenous injections of tartar emetic

Blastocystis homin s —Ramsbottom considers this non-pathogenic fungus as belog ing (morpholog cally) to the s me group as Rhinospondium Blastocysts are frequently found in stool exam natious and may be mistaken for amoetize or other protozoa They are particularly abundant where the amocha Dienlamodo Jesuliu is done (symblosus?) B homes it is parastee of the large untertine. It is a frequent containant of cultures made in examinations for amochae. Brumpt reports this lunguation of cultures made in examinations for amochae. Brumpt reports this lunguation of the containant of the containant

Blastomycosis —Blastomycosis of the American type or Gilchnists ofsease, is characterized by granulomations and suppurative processes of the skin and subcutaneous tissues and sometimes of the lungs and other internal organs. Most of the case first discovered in the United States were in the region of Chicago but later they have been reported from many parts of this country. Marhn and Smith (1939) write that case have been found in at least 18 states. They have also been reported from Canada Puerto Rico Cuba South America, and Europe. The cases have been more numerous in males than in females. The blastomyce have been found, especially in the pus from the lesions and sometimes in the sputim

Gilchrist in 1896, described the organism causing human blastomycetic dermatitis as encapsulated and budding in tissues with mychelia forms in cultures Dodge has classified this yeast like fungus in the genus Zymon ema Z dermatitidis (usually honever classified as Blastomyces dermatitidis) Other species have also been reported in blastomycesis as Cryptococcus gitchristi and Cryptococcus hominis (Viullemin) in Europe

In tissues there are found spherical or ovoid cells usigly or in groups varying from 7 to so in diameter. Budding forms are common and the thick highly refrictile membrane makes the cells appear as double contoured. In cultures of Bastonyese demotication on sould media there appears about the third day a small creamy predict (coremia) colony which shows bryhase about 3s in diameter. Chlamydospores (7 to 85 m) may be terminal or interreliary. The sexus in 8 spored. No pellicle is formed on sugar broth. The guines pig is susceptible to infection but the monute is more susceptible and may be inoculated either intraperation ally or intratesticularly. The infection is fully developed in the laboratory animal by the third week yeast like bodies being present in the tissues nodules.

The disease may start as a sha lesson or this may be secondary to a primary pulmonary invasion. The skin lessons may resemble a vertroose tuberculid a syphultite gumma or a sporotrichosy lesson. The exact diagnosis depends upon laboratory test. In generalized blistomycosis the lung is involved in more than op per ceto of the cases and in skin blastomycosis at its secondarily invaded in about one third of such cases. In primary pulmonary blastomycosis a bronchopneumonia occurs from which the infection may generable. There is less tendency to cavitation than in phthasis. The sputum is apit to be blood stained and may contain the fungus. Next to the lungs and skin the infection most frequently invades the kidneys but the organism is not apit to be found in the urnumless there is invasion of the bladder or prostate. Bone and central nervous system involvement more rarely occur.

Mattin and Smith (1939) who have analyzed the reports of 340 cases including 13 of their own recognize 2 climical types of infection (1) a cutaneous one which proceeds as a chronic or subacute ulcerative process and which issually responds to treatment with iodides or radiation and (2) a systemic form a highly fatal disease characterized by pulmonary infection and wide spread distribution of lessons. Antibodies were found in the serio fosme patients who were heavily infected. See p 1194.

Prognosis—If the infection is of the cutaneous type and does not become systemic the outlook is usually good. In cases with generalized infection and pulmonary involvement, the prognosis is unfavorable and

the disease highly fatal

Martin and Smith (1939) found that in severe cases a hypersensitive ness to the fungus develops which can be estimated by cutaneous tests



Fig 50-Z d m 11 d1 (C g t h st) D ubly c ntoured org n sm f und my (blast my) (From Bus hk ft Hyd ad Montgomery)

and they think it can be reduced by repeated injections of heat killed vaccines. They think it is dangerous to treat cases that are allergic to the fungus with potassium iodide and recommend treatment first with vaccine.

Treatment—Lord (1936) lays stress on the improvement of the general untrition and the administration of potassium builde. The local cuta neous lesions usually respond to treatment with budies or radiation. The local lesions may be in some cases advantageously excised or aspirated drained and irrigated with 1 per cent copper sulphate solution or with rodine.

Bush (1941) has reported upon the treatment of a chronic generalized case of blastomycosis in which curative result was obtained with includes and radiation with the Roentigen ray

However large daily doses were necessary as 360 grains (23 gm) daily

The drug was given intravenously

They are particularly abundant where the amocha Demianwels Iraquit is found (symblosay). B horizont is a paranter of the large interior. It is a frequent anumant of cultures made in examinations for amochae. Brumpt reports this fungational map one cent of a series of stool examinations. It varies from 3 to 5 is an indicated and has a large central variole which does not attain dark horizon as does the given mass of Isodomocho. The periophisms surrounding the vacciou's varies in these in different sections of the ring and shows a varying number of nuclei. Budding form may be seen.

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FUNGI 1150

of human infection with cutaneous lymphatic lesions of chest wall due apparently to this same organism was observed in Manila and cultures of the Cryptococcus obtained

Although the patient was only seen on to occasions there was no evidence of visceral invol ement and general indiction and the lesson heated in several months after complete even on and curettage. The organism was definitely identified as a fungus (Grotal). However, for a long time it and seecached by a number of other patients of the contract of t



Fo 252 -- Came a lucid d w g of ult e f C yet sf m s

the wound healed but I ter a numb r of other small ab ceases occurred in the regio of the writt whe also healed after measons. Shoulty alterwards there appeared nduration of the lymph we sels along the upper border of the radius. This d appeared everal weeks later. However later supportation occurred in the sear. The patient was then treated with injections of odo intravenously and c injectely recovered particularly as the patient of the patient was the patient with the patient was then treated with injection and the patient particularly as and the patient patient patient patient in the patient pa as the compound solution of sodine USP with admixture of sodium thiosulphate and Bush reports this was a convenient safe and efficient method for administering iodides. The thiosulphate is added to prevent sclerosis of the veins

Meningoencephalitis -Dodge and Ayers isolated a lungus from the surface of the medulla in a case diagnosed as meningoencephalitis. The name given this parasite



case of Dr J B Bu h Alabama (Courtesy Arch Dermat & Syph.) Fig 251 -Blastomyco

was Zymonema capsulatum. In the lesions only budding cells were found. In cultures thin walled hyphae (3 5 to 44) were noted Chalmy dospores developed from racquet mycelium The relationship of the organism to Hesta plasma is not clear (See belo v)

Lymphangitis epizootica has been recognized as a fungus infection especially of the cutaneous lymphatics of the horse since 1883 when Rivolta described Cryptococcus farciminosus as a cause of the disturbance The lesions which consist of nodules and ulcerations of the skin in situ ations rich in lymphatics are frequently found where irritation from rubbing of the harness may result The disease extends through the lym phatics and is a chronic one It has been observed especially in Asia and more recently in southern and western Europe and northern Africa was studied by Tokishige in Japan in 1896 and in the Philippines in 1902 by the writer in an outbreak resembling farcy Four years later a case

United States in which they emphasize the enormous number of parasites seen in bone marrow preparations and they suggest sternal puncture studies for diagnosis. In one of their cases the diagnosis was made before death

Meleney (1940) has analyzed 32 cases of histoplasmous of which as have occurred in the United States Thurten of the cases which he reviews have not been published before. He points out that the macro scopic pathology has varied with the clinical manifestations. In most of the cases gray or white nodules or extensive areas of necrosis have been found in one or more organs and in the lungs abscrss cavities or tubercu lous cavities have been encountered. Caseation of the adrenals has been found in a number of cases and in 3 the adrenals we the principal organs or only organs involved. Some cases have shown ulcers in the small or large intestine either very superficial or deep. Nodules have also been found in the submucoso or deeper coats of the intestime. In a



Fig 253—1 tells Sacho myce ess (Copin)

few cases occurring in infants there have been no macroscopic lesions suggesting local areas of necrosis but the organisms have been discovered in the spleen. In a few instances the lesions have been confined to the infants of the discovered in the spleen. In a few instances the lesions have been confined to the parasites. In some cases the organisms have been limited to the necrotic areas. In other cases they have been found widely distributed in the organis of the body which are not in reticuloendothelal cells

He has since (1911) described two further cases which were of interest on account of the pulmonary features which before death had led to diagnoss of malgianit disease and toberculosis. The correct diagnoss was not made until after death when it was found that the lungs were involved in nodule formation with cavitation. Acid fast bacili were found in both cases but sections of the lesions revealed endothelial cells packed with the causative organism.

Detry (1942) and his associates have reported the first case from England Post mortem examination revealed a large mass behind the Histoplasmosis Ilistoplasma capsulatum—Darling in 1906 re ported in Panama 3 cases of fatal human infection caused by an organ ism described as Ilistoplasma capsulatum. The disease resembled in many respects kala azat and was accompanied by splenomegaly and leukopena. The organism was first regarded as a protozoan Rocha Luma in 1912, suggested it was identical with Cryphococcus foruminosis

Watson and Riley (1926) reported the first case of infection in the United States Subsequently 9 other infections were reported in this country of which 8 were in adults. The mith case which was reported by Shaffer and his associates (1939) was in an 11 months old child and the tenth case, of Amolsch and War (1939), was also in a child of 8 months. Both cases were fatal and the organism was discovered in the speech Reid, Scherer and Irving trough have reported 2 cases in the

	Refúnited my	STATE OR COUNTRY	408	02.1	RACE	T	DISTRIBUTION OF PARAMETER						
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Summary of human cases of h stoplasmons, showing di tribut on of the p ra t

(After Mel ney)



liver with necrotic areas containing the yeast cells. The organism was identified by cultures as Histoplasma capsulatum

Henderson Pinkerton and Moore report a case in a man 70 years of age in which there was ulcerative enteritis a condition which has been referred to by Meleney in the analysis of other cases

DeMonbreun and Anderson (1939) reported an infection in a bull terrier in Tennessee the organism being demonstrated in cultures of the blood before death and in the postmortem examination

The infection was transmitted to young dogs both parenterally and by mouth, both with material from the original dog and by the inculation of cultures. Experimental infections have also been reported in monkeys and mice. Hansmann and Schenken (1933) have reported the infection of guinea pigs rabbits dogs and rats with a species which they named Histoplaima pyrforme. Niño in Argentina has described a Cryptococcus which caused a generalized infection originating from an ulcerated condition of the face. The organism was cultivated best at a temperature of 22-25°C but no growth was obtained at 37°C. Guinea pigs white mice and rats were successfully inoculated. Negroni (1938) has reported acids from the Argentine. Villeda (1931) has reported the first case in Brail which was in a child and which resulted fatally. In this case there was diarrhoes with blood in the facees and progressive emacation.

Ciffers and Redaells believe that Histoplasma may be the cause of a form of dermatitis evfoliative associated with lymphadenitis The fungus cells were found within phagocytes in the enlarged lymphatic glands

Brumpt (1936) classifies Cryplococcus farciminosus in the same genus Histoplatma together with Histoplatma capsulation On the other hand Dodge has classified Cryplococcus farciminosus under the genus Ermonema II one compares the cultures of these two organisms their differentiation is clear Cryplococcus farciminosus never produces my celum in cultures and of the type which Histoplasma capsulation does Benham has recommended the term Cryblococcus homius for organisms of the latter type

mended the term Cryptococcus hominus for organisms of the latter type
Conant (1941) has made a cultural study of the life cycle of Histo
plasma capsulatum and beheves the fungus should he placed in the

Monihacea of the Fungt Imperfects

was used as an antigen

It is not clear just what the relationship of the fungus which de Monbreum has isolated from the dog is to H farenminosis. His illustration of cultures of the dog species suggest at is a different one

Diagnosis Many of the cases show irregular fever emaciation splenomegally leukoperna and anaemia Diagnosis by biopsy and the demonstration of the organism by microscopical examination or by cul tures of it are methods of choice when lesions are accessible Zarafonetis and Lindberg have suggested that intradermal skin tests might be employed for diagnosis in which a filtrate of a culture of the fungus

four mycelum at becomes Cryptococcus (an asprongenous yeast) When Embowyces toose the power to form mycelum at becomes Sackiensowyce a true yeast which never forms mycelum and reproduces by budding and the formation of ascesspores (resulting from the conjugation of adjacent cells or by parthenogeness). The false yeast at the contract of the contrac

Clinical Types —(1) Besides thrush and perfeche (mycosis of the angle of the mouth of young children with macerated whitish areas)

we have moniliases of the perineal or inguinal regions of infants particu larly those poorly nourshed Prob ably many of these monilias saprophytic and only develop in individuals of lowered resistance are very common findings in the stools of normal individuals and these may find a suitable soil in cachectic children in regions adjacent to the anus Some of the so called body eczemas and dysidroses of hands and feet are associated with moni-Many cases of athletes foot particularly where the toes are closely approximated belong to the moni



55 -Th ush fungu (K li and W rm nn)

hases although by far the greater number of such cases belong to the ringworm group

Dodge points out that species of Monities are pred in nantly suprophytic. Of 53 species referred to the g me for it Banka by him the emay be noted Castillan. I possible and G p Jimonal is both of which were connected with pulmonary or ditions incident to impective of ten dust inhalsed by prepert gard, teas. Many of the species listed by Dodge are based on a unple case and many of them fa I to sh w a y pathogenicity (and a e apparently sap ophysics).

In the genus $Syr_1 \in syr_0 a$ he class firs the species alb = n the classical fungus of thrush refer red to aloe. In this same genus is classified $Sy = gsyr_0 a g \cdot i b$ ($Alb = ia \cdot p \cdot i \cdot s i + ia \cdot s i$) which was reparted by Ashford for a numbe of years as the cause of sprue. This disease howe or is now recogni ed as a deficiency disease closely related to netric ous anaexams.

St ut (1938) emphasises the ea e that on should take a describing as the euloforcal fact I yeast his be dues which may be causally found in and immatory less ons of the st or in the sput me facres unless they are dem nutrated to be pathogenic species. In the sput me fact many ce set in as the kept, much take many ce set in as the kept, much take the many ce are in as the kept, much take the special control of
The prognosis is generally unfavorable when the fungus has become widely disseminated Only a few cases of recovery have occurred

The NIMENT—When the primary lesion occurs in the skin the infection may sometimes be precented from extending by early existion and curretting. Negre and Brider found that incision of the abscesses did not result in complete cure until 606 (salvarsan) was administered. In a case treated by Clemens and Barnes (1949) in which the primary lesson was possibly an ulcer on the face this was healed after treatment with bismuth. However this patient was also a syphilitic and the parasits was recovered from lymph nodes after death. In one case reported by Meleney in which the cervical lymph nodes showed the organisms the patient recovered after treatment with neostam a pentavalent animony preparation. Meleney behaves that animony preparation such as potassium animony tartrate the threather organic preparations such as fouadin and the pentavalent preparations such as neostam should receive particular attention in therapy.

THE MONILIASES

There is a large group of fungus infections which have been attributed to various yeast like organisms many of which show my celial development



Fig 454 -Fnd myces v llemms Mycel at thread with four r pe chlamydospores and comid a in the m ddle of the picture (After Plaut)

in cultures The best known of these moniliases is 'thristh in which growsh white membranous patches form on the mucous membrane of the gums tongue buccal cavity and pharyax chiefly affecting marasmic infants or feeble old people The fungus rarely attacks well nourished individuals.

On examination of a fragment of such membrane we find yeasthke bodies which when cultured tend to show a yeast morphology on solid media and a myechal one in hourds

In stab cultures of agar or gelatin there are found yeast like forms on the surface but lower down on the stab (partial oxygen tension) we have an outgrowth of mycelial threads showing budding. The addition of extract of carrots to the standard media promotes mycelial formation.

Mithough the generally accepted name for this funguary. Months additions (the name Ordina militoria was given at an earlier date—1853) this although species has been as good by different authors to many other genera of which might be mentioned acceptance of the months of the might be mentioned as able which gives a sample differentiation of the yeast like organisms often retirred to an monthissa literature in Endowayes there are both mycleium and bounded cells the mycleium forming asso by fusion of contiguous cells. Losing the power to form asconnover the fungus becomes a Menula Should at M. site loss the power to

form mycelium it becomes Gryptose cur (an asporagenous yeast). When Embonyces tooses the power to form mycelum it becomes facel, sengues a true yeast which never forms mycelum and reproduces by budding and the formation of ascospores (resulting from the conjugation of adjacent cells or by parthenogeness). The false yeasts attend to the propose of the conference of the various would see a strength of the conference of the various would see a strength of the conference of the various would see a strength of the conference of the various would see a strength of the conference of the various would see a strength of the conference of the various would see a strength of the conference of the conference of the various would be seen to the conference of the conferen

Clinical Types—(1) Besides thrush and perleche (mycosis of the angle of the mouth of young children with macerated whitish areas)

we have monitudes of the permeal oringuinal regions of infants particularly those poorly nourshed. Probably many of these monitudes are superpolytic and only develop in individuals of lowered resistance. Yeasts are very common findings in the stools of normal individuals and these may find a suitable soil in cacheciu children in regions adjacent to the anus. Some of the so called body eczemas and dy sirbores of hands and feet are associated with moni-

has Many cases of athletes foot particularly where the toes are closely approximated belong to the moni



F & 255 —Th u h fungu (Kolle and

liases although by far the greater number of such cases belong to the ringworm group

Dodge points out that species of Menths a c predominantly suprophytic: Of 33 species effected to the genus C: Hanna by him there in y be noted Catillariant a pet and of C pulme slir both of which were connected with pulmon ry conditions incident to 1 spection of text dust in hie bely to species possible to E Many of the species lated by Dodge a c based on a single case and many of them fail to show any pathogenicity (and are apparently suprophythes).

In the gen s. Symng p p n he class fins the speces 16 nr the classical fungus of thrush referred to above 1n the same ge n is classified Sy t p $rac{n}{p}$ in loss (Mo in p sinc) n which was regarded by Ashford for a numbe of years as the cost of sprue. The disease however is n w recognized as a d ficiency disease closely related to permones an anema.

Stutt (593) emphasures thee re that one should take m describing as the etological for years the bodies with may be examily found in mill immatory leavons of the skino in the sputum or? ees unless thy are demonstrated to be pathogene species life; and out that in my ce as in our to be high in much that inmay skin lessons supplied to the study of the stud

chronic bronchitis or pulmonary toberculosis a great number of monilia species have been reported Aginal discharges may also be due to species of monilia as well as to Trickomonar rayinalis.

Torulosis —Another ill defined group of yeast like fungi with patho-genic properties are those listed in the genus Torulo in which the organisms reproduce only by budding do not produce mycelium or endospores and do not ferment carbohydrates. They rarely if ever cause lesions of the skin but appear to bave definite affinities for the tissues of the central nervous system and the lungs though they may produce destructive granulomatous lesions in other organs of the body. The respiratory tract is regarded as the probable portal if error

Freeman (1931) collected a number of cases of central nervous system involvement which suggested neoplasm or encephalitis but were associated with the presence of years like organisms Torula histolytica

Dodge has called this organism Gryptocccus histolylisius Gryptoccus histolylisius propoduces only by budding the yeast like cells averaging a to 4s in diametr. The whitish to yellowish colonies on glucose agar appear beaped up smooth pasty shiming and thick. They do not cause fermentation pellicel formation or liquidation of gelatin. The attrium of infection is probably pulmonary. The brain lesson coinst of tuberiel hist formations and the lungs often show the amen appearance that the proposition of the proposition of the cerebral grey matter the organism liquided gelatin after 16 days Dodge has named it 6 menungitids.

The involvement of the cerebrum and meninges in torulosis suggests a brain tumor partirularly because of the eye symptoms such as choked disc. A diagnosis may be possible by finding the yeast like organisms in the cerebro spinal fluid. Brumpt places the fungus of torulosis in the genus Torulopisis (T histolytica) Stoddard and Culter Hirsch and Coleman Massee and Rooney and others bave reported further cases in the United States. The prognosis is usually unfavorable. The test ment has been unsatisfactory and the infection can only be treated symptomatically.

The genera Cryptococcus and Melause is are often placed in the group Sarcharo myrectareat mapeterate (prefet stage unknown). As regards Melause is Dodge states that it is uncertain whether the genus belongs with the yearts or the dermato phyter. As the very common shan kenon phytrams versacion: is generally grouped with the dermatophytes it would seem more convenient to deal with Melause and under that teroupone.

FUNCI IMPERFECTI (HYPHOMYCETES)

Sacrado classifies under Pump Imperfects a man groups Sphareopaidera Melan contear and Hyphomycetes but of these only the Hyphomycetes are involved in horan pathology. Very confusing is the fact that in this class of fungi various workers have assigned to different stages of the same fungus different stages of the same fungus different spense and specific names and another difficulty is that in the Hyphomycetes the complete life cycle is not entirely known.

Pityriasis Versicolor (Timea Versicolor)—This very common skin affection is characterized by dirty yellowish brown spots occurring upon

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covered parts of the body especially under the clavucles. These spots are sometimes referred to as liver spots. The plaques are not elevated and do not show inflammation. A vigorous sweep of the thumb nail superficially across the patch (a sterile instrument is preferable) does not bring blood (Sipie dis conje d'ongle). The scrapings provide material showing an abundance of mycelum and spores of Valaste in furfur. The hyphae are from to 3µ in dameter and the spores from 3 to 8µ. The spores are very refractile and may show budding

On alternative white drops appear after a week. On Sabouraud's medium the primary growth a receded nyl sew months may clap e before a colony the sure of a new grain is formed. Catelhan smits that the species found in tropical contines is Madist. arraying capturing its of Trace from IR that described in Ceylon a form of Palystan in g a which has cross to black spots upon the skin and from which he reported the spotates of the species of Comparism smars in.

Treatment—The skin should be thoroughly cleaned daily by scrubbing with incture of green soap and then sponged with a saturated aqueous solution of solution thosulphate. Further treatment for severe infections may consist of daily applications of Ung hydrag ammoniat dram I to the ounce. Such treatment is satisfactority effective. The undergarment should be sternized to prevent reinfection.

Espiratean — The is sometime cool sed with p tyricus but in a dist of akin affection with it, caused by the is system or a sussent (A corporare multiur is). The investions averages to in diameter often fragmented into bacillary arthrospores (Cultures are unally) against Espiratean aposts are dark red to brown this (usually in the groin reg on or analis). It is often covine of with tricophylosa or licked with surface properties of the covine of t

THE RINGWORM SAIN AFFECTIONS (TINEA)

Definition —Contagious infections of the skin hair or nails produced by various fung. These derivations, oceas may vary greatly chinically even as regards ring formation but are grouped together because they tend to involve only the epidermis. The chief parasitic fungi invading the superficial skin layers belong to the family Trichophytonese.

Dodge das files these dermatophytes as probably impe fect stages of Gymno acc ceae Sabouraud ets distribution of these fag here accepted is stated on both chiratial and mycolog cal ground and has been the gude of most dermatologist for the p st 40 yrs or vit this and go name our subable stud es and ci sifed nos made by Castellam and Chalmers (1919) Vmillemm (19 5) Langeron and M lochevitch (290) 4 others.

The singularms involving both scalp and glabrous skin are classified as the endothrix group the ectothrix group the microsporum group and favus

The Endothra Group—It is usual to divide this group into an endo thrix and a ne endothra group. In the former the hyphae are confined to the interior of the hair while in the latter in addition to hyphae in the interior we have a few hyphae growing along the outside of the hair Arthur Whitcheld notes that early in the invasion of the hair we find the

fungus in the root sheath as well as within the hair but the external ones soon die out, leaving only the hair invasion. In the so called neo endo thrix infections, the invasion of the root sheath continues for a longer period

In the Melmitenus multype of magnorm of the scalp (Trackophyton tonumus) we have many normal hairs in the daze of alopeas, and the diseased hairs project from 10 a mm above the scalp purface. The scales covering the affected spot if gently removed show flattened diseased hairs plong beneath below often assuming buarre shape. This infection rarely itches. It is a diense of young children and disappears at piberty—the absence suggested that gonada alexivity explains the age exemption. It is very—contagious. The quadracquiar cells of the hyphase (often called sporre) are a to is along. A powdery cateriform growth results on 3 shourands medium. Guines pay can be



Pro 256 - Epidermost yton ft e sum from sk a scrap ags (Low and high power)

infected. This ringworm also occurs on the face neck and hands of children aboning the infection as red areas with little vesicles or papieles. It has been reported occasion ally from cases of ctomycosis and onychomycosis.

The Sabeuraulia unitype: caused by Techophylon adourauli (T ecumentum) and in quite common in wettern Europe but of fice frequency than the Maintenia True tensuraus. The harm break off close to the scaly scalp patches and show as black dost on the scalp surface It may cause a truchophylosos of the bands and secondarily of the mails. It may invade the beard. The alecurospores are from 5 to 7 m in diameter and very fragile. Cultures are rather cupola hite.

The Ectothrix Group—In this group mycelium is found both within the hair shaft and in the root sheath surrounding the hair. The designation "endo ectothrix has also been used for the ectothriz group. Sabour and separates a megalospore and a merondes subtype. The chief species of the large spore group is Megatricalphysion raseum which is rather common in the north of England where its spread seems to be through the barber shops rather than from contact with animals. It has spread rather widely since the war being reported from France Germany and in the United States particularly Philadelphia.

The lesions are of the skin or of hair follules but chiefly of the beard and are rather dry showing no tendency to suppuration

FUNGI 1167

In the nucroides group the common funous is Ectotrichophylon mentagraphyles (Trich phyton gypseum var asteroides) In sycos s sutgaris (harher s itch) the lesions consist of a follicultie of the scalp or re-ions of the heard complicated by 1 fee tion in addition with pyogenic cocci. The inflammation results in a suppuration of the foll cles containing the dead has a Thi same fungus when it invades more deeply the tissues is probably the most common caus of kerion in which on the glab our skin we have patches riddled with openings from which pus oozes on pressure. These natches are often on the backs of the bands or forearm in addition to the scalp and occur frequently in those who work with horses When on the face or scalp the affected hairs can easily and painlessly he extracted from the root sheath they are however quite brittle and may break off Epilation of the infected hair shafts is indicated On mounting in caustic potash solution we find strings of scores (Su) on the hairs extracted from the pe inhery of the lesson or in the pus The sheath at the base has spores varying greatly in a ze (z to 11µ) The microides spores of the sheath may be confused with the small spore sheath of M crosporum audousns but the former are arranged in the ns while the latter show masses of polyhedric spores about 34 in d am eter Sullon and Sullon (1939) recognize a deep chronic infection sometimes resulting in a gr nulomatous type of eruption

The Microsporum Group -These small spored it gworms I the scalp are the most common ones in France and the United States It is customary to recognize a human type which is important only for the scalp as the lesions which may appear on the glabrous skin of the neck are rather insignifi ant and come from scalp transfer. It does not invade the beard. The name of this fungus is Microsp um a d are a of alopecia of this human type show greyish scales covers g an area with definitely outlined hor lers and covered with diseased hairs broken off about a to 4 mm from the scalp surface. The area neve shows any normal hairs. On epilating one of these greyish stumps of hair we note a whitish collar of polyhedric spores (2 to 34) which never penetrate the shaft of the har The spores f othe common types of scalp ringworm tend t he larger (5 to 74) This infection attacks young children almost exclusively and Brumpt advises us to think of an animal origin when we find one of these small spored ringworms in n adult. The human type r rely c uses even super ficial pustulation. Of course this may occur from hacterial infection in scratching by the child Castellani (934) reported that the species M scol c is (Bodin) I ad to permanent alopecia in Ceylon and China

The animal species of Microsporum (Sabouraudites) which have been chiefly studied are the e helonging to the horse the dog and the cat That of the dog M canes (M I norum) produces both times tonsurans and circinate herpes in both children and adults. The lesions are generally scaly and dry. The cultures grow more rapidly th n those of the human type and they show more abundant fuseaux. The cat species (If fel new) seems to prefer the glabrou skin producing dry crythemat us les ons which may go on to pustulation Some ker o s are due to the cat ringworm. It grows ery rapidly in cultur s It is common in England but tess s in the United States

Favus -This disease usually affects the scalp hairs although invading the glabrous skin and pails. It is characterized by golden yellow cup shaped crusts (scutela) which form about the hair follicle orifices The scutulum is made up of tangled mycelium surrounding the hair with verticle mycehum externally and underneath a pus cell layer. The scutula may remain isolated or form dirty crusts on coalescence. If this impetiginous crust is removed the yellow color appears. The odor of old favus lessons is that of a mouse nest The causative fungus is commonly Achorson schoenlesns (Grubyella) However Weidman (1937) distin guishes five species Achorion schoenleins galtinae quickeanum gypsum and violaceum The evolution of the condition is slow Some European dermatologists believe that the disease is contracted only during infancy but that once it is acquired it never disappears entirely spontaneously However Brumpt reports that there are exceptions to this latter view Sutton states that no age is exempt from infection. It is moderately infectious and spreads by direct contact

The affected hairs are lusterless and greyah and while more fragile than a normal hair can be equilated entire. Searming may result. The favor hair filled with abubbles. The septate hyphaft excessed may result a filled with a bubbles. The septate hyphaft excessed and resemble cerebral convolutions. The growth is much alower than that of Treckoplysics and on microscopic examination there are fewer fuseaut. On the glabrous skin we may have setural but more monely acally patches. The involvement of the nails is rare and always follows lesses of a prior human case one must suspect infection from an animal source particularly from microscopic and the state of the s

Eczema Margunatum and Rungworm of the Hands and Feet—The above epidermophytoses are characterized by invasion of the horny laves of the epiderms alone. The nogworms of the hands and feet are generally caused by Epidermophyton interdigitate and Hebra's eczema marginatum by E floccosing (E cruire).

EPIDERMOPHYTON AND ENDODERMOPHYTON INFECTIONS

We may separate the ringworms of the genera Epidermophylon and addictionably ton from those just considered by the fact that they do not attack the hairs. Even in time imbricata when the Endodermophylon spreads to the scalp it always respects the hairs. In Epidermophylon infections the fungus is found characteristically in the stratum crimewood the epidermis while with Endodermophylon the typical location is between the stratum corneum and the stratum fundoum of the Alalipshian layer of the epidermis. These fungin ever invade the corum

The Epidemophylon dermatomy coses are wide spread in both temper ate and tropical climates while the Endodermophylon ones are strikingly restricted to the tropics. Mansons description of the fungus of time imbricata (Tokelau ringworm) from his studies of the morphology of the organism as seen in the scales and his accurate report of the climical course of the infection following human monulation is a classic

The two genera are best differentiated culturally. In cultures of Epidermophyton floccosium there is a profusion of club shaped clostered to the profusion of the produced by about 4 Septa

spores (fuseaux) often in groups of 5 to 7 and divided by about 4 septa With Endodermophyton there are no fuseaux

TINEA CRURIS

Epidermophyton Infection —Under the name dhobic sich this fungus affection is probably better known to Europeans than any other tropical

shi disease. The name dholue or washerman sitch has been given on account of associating it with the indection of the underelothing while being washed with the garments of those who have the affection. This view probably has some foundation but it has been difficult to verify it Hebra described the condition as excerne marginatium; it 800 and since that time very little has been added to his chinical description. It is also known under a variety of names some of which are the following derma titus bullosa plantars dermatitis rimosa. Hong Xong foot eczematoid dermatitis dermatitis cine since arcinata etc.

Epidemi logy—The organisms of diable itch seem to be vide spread if not ubiquitous. They are exceedingly common on the feet. This mycosis spread amon the inmates of schools barracks and gymnas use and may be passed along by batthub and

bathing tanks. The fungs hee for long periods in shoes slippers and socks and may be acquired from towel or perhaps by shaking hands. Some individuals seem to be more susceptible than others and it has be may pested that differences in this respect may be due in part to the different activity of the sweat rhands.

Symptomatology—The favorite site is the crotch although the sailary region is also frequently involved. The process starts as munite papules but these rapidly develop and give rise to angry red wollen patches with sharply de limited margins. These red fest tooned patches are usually limited to the perineum scrotum and anner surfaces of the thighs. The itching is often distressing and



Fig 257-Tn u (From Maye)

many secondary infections or eczematous lesions result from the fierce scratching of the parts. If the patient goes to a cooler place, the process may subside only to return when he comes back to the hot moist climate where the infection was originally contracted.

In some cases the fungus my ades the region between the toes and gives mise to very intolerant teching and from secondary bacterial infections to a condition known as mango toe. Other favored sites for the growth of these fungu are along the outer and mine borders of the foot in the plantar concavity opposite the mistep and in the crease between the buttocks. The lessons on feet are well known under the designation of athletes foot. They frequently spread into the interdigital spaces of both hands and feet thence spreading to the palms and soles. Eczema pompholyy, cheripompholyx and a number of other names have been given to these hand and foot manifestations.

Dodge gives E interdigitals as the principal cause of ep d rmophyto is of hand and feet and E if cosum as that for exzema marginatum. The growth of the interdigital

lungus is more rapid than that of the one affecting the inguinal and periodi regions. Numerous cases of \$\textit{E}\$ the interpretation and extensive lichtunglic cryptions of their have been reported in the lar East and in the United States as due to the special rechephylon (purparisen) relations by Lewis Mentgomery and Hopper (1938) and by harsts and Conant (1940). In the body ungesorms scrapings should be obtained from the borders of the lesions and in the interhiptation or preferribly from the small grayable blue sago grain his vesicles if present. The material should be cultured and examined microcoporially in caustic postar house.

Disgres is —The diagnosis of mytonic affections of this type should always be confirmed by the nucroscope. Continuately the nucroscopic diagnoss is quite simple and usually successful. All that is necessary is to take a small portion of epiderms from the periplery of the isom or the root of the vesticle and immerse it for a sufficiently extended period (3) to 34 hours) as a 37 per cent solution of N-MOII. This is done or a slide the prequartion being covered with a cover glass and scaled with vaselvier the longer period of observation is required. The larger the portion of epiderms takes for examination, the longer the time required for a sitisfactory clearing. Figure 35 shows the amoreainme of the modular succh a preparation.

Program—I very through superindection these myectic affections as a newer dangerous to life. The fung imprisoned in scales have been said to survive for overa year so that a patient might be reindected from his own shoes sippers etc. As the organisms multiply in the epidermis they may live and carry over infection to most chorolide sites without ever being thrown off from the skin. Here the advantage using medicaments in the chronic forms of mycosis which will keep the leanons dequising multiply matter might be supported by the second of the

Treatment—Tincture of rodine and saleylic acid have been found of great value in the treatment of this group of my coses. When the lesions are fulfimmant and bacterially infected, the inflammation may be treated with mild anuseptics and of these potassium permanganate solutions have a well deserved reputation.

Stift believes that the other types are often favorably treated with timeture of soldier either full strength or diluted to suit the case. For chonon emproises of the feet is thorough painting of the sides plantar surface and between the toes paring partney's attention to the toe nail once every two needs will ke pite condition subded when nothing else will serve. In such cases the caution should be observed to stop the action of the ordine after from 10 to 15 minutes by minutenesing the foot in water and sections vigorously with soap. This treatment cases—uperficial desquantation detries the following week. An outhent of cold cream applied at might will faciliate the brate ment. All vesseles should be punctured before applying the functure of sodness are for questly success, fully treated with trusture of sodnes.

A common method of applying salicylic acid in this class of mycoses is in the form of Whitheld's outlinest. It is composed of salicylic acid 6 per cent benow acid 12 per cent in vascline. The outlinest may be used full strength or dulited.

Other medicaments which have been recommended are thymol, resorcia ammonisted mercury eucalyptol phenol and thymol include (aristol)

Masson Bahi and others have recommended in awere cases chrysophane and opinions to grains to the ounce of asothe respected twee a day until a sight erythem above at the edge of the diseased edge. Chrysophane and however will stain the others and its use must be diseased edge. Chrysophane and however will stain the others and its use must be diseased edge on the face. It may be combuned with chloroform and hould gutta percha and panted on the slaw with a brush on alternate singhts

And chrysophan Chlorof Liq gutta perchae gr xx (r 3 grm) 31 (3 5 cc) 31 (28 42 cc) A synthetic pr paration of chrysarobin which is known as eignolin is said to be free from tone action on the kidneys and can be applied to the scalp without danger of conjunctivit 8. It is frequently presembed with tar as in the following prescription

Ol cadin (deod.)	mai (2 368 cc)
Cignolin	gr sv (o 259 grm.)
Benzol rect	31 (28 42 CC)

Another preparation especially recommended for treatment of athlete's foot is merticolate cream Eli Lilly & Co

The infected patient should take every precaution against the apread of the fungus

and should wear fre h paper shippers which can be burned

X ray therapy has been reported as of great value particularly in cases in which the infection move es the fingers or toe mails. It has also been especially employed in These sefection of it is really in children where it is off in assential for successful treatment to remove the infected hair. When and Solzberg r (1937) state X ray epilation is safe and user if done by an expert.

Applications of barrum sulphide with equal parts of zinc oxide and starch mosatened and applied for a few m nutes (only) has sometimes been employed while other derma tologists have performed epilation with forceps Formerly the production of a tempor ary allopecia in the treatment of ringwo m of the s alp by the administration of acetate of thallium was noted. However as Sabouraud demonstrated this substance is most poisonous in overdoses, the toxic dose is near to the disc efficacious for the production of epilation and a number of deaths followed its use. It is believed the drug bas an effect on the endocrine system as well as on the sympathetic nervous system | Iodida therapy is advisable as an ant dote in poisoning. It is now recognized that no one over it years of age can be given the drug with safety. Ingram recommends a single dose of not over 8 5 mg per kilogram of weight. The dose should not be repeated for at least two months. The has I os as and falls out from a to 24 day after the drug has been taken and the new h ir begins to grow by the a5th day. This method of treatment is at parently still employed extensively in parts of Russia and in Spain and Mexico to a less e t at in England and the United States Percival (1932) states that the average durat on of the course of treatment with X rays is about 135 days while that f acetat of thalloum is about \$13 days Brumpt beli ves that in certain rur I districts where X ray treatment cannot be obtained the acetate of thallium is the most pract cable method of treatment

Treatment with v come made from the fungs have not definitely been proved of value

TINEA IMBRICATA (MALABAR ITCH TOKELAU)

Endodermophyton Lufecton —This form of tropical magworm is found chedy in the islands of the South Pacific and in the Malay Archipelago It is also found in southern China southern India and Cevion It has been reported from Colombia Brazil and from Guatemala by Figueroa and Conant (1940)

On account of the disease having been carried from the Tokelau Group to Samoa it is often designated tokelau. Manson was the first to recognize the affection as due to a fungu which he demonstrated micro-scopically in the scales. The specific cause of tokelau is Endodermobbyton concentracing. Trichobyling concentracing.

He was also able to transmit the disease by inoculation experiments and found that after about ten days a raised brownish spot appeared at the site of inoculation. This spot increased in size until when about one fourth inch in diameter its central portion became detached thus giving rise to several thin, rosette like scales, free at the center but still attached peripherally The fungus advances peripherally, leaving a smooth sur face within Also there is a similar process developing in the original central spot again to form a circle of scales within the older and more peripheral circle. The process is repeated until several rings of scales are formed each originating from the central focus as concentric ripples form on water from the fall of a nehble

These scale circles are from one eighth to one half inch apart and give a festooned appearance to the affected skin. It was formerly supposed that the causative fungus was Asperrillus concentrous but Castellani has demonstrated that fungs of this genue when present are merely acci dental. He has isolated in cultures what he considers the causative fungus Endodermobbyton concentracion. Scales were treated for to min utes with absolute alcohol and then a single scale was placed in each of a series of tubes of maltose bouillon

The fungus grows between the rete malpighu and the external epi dermal layers forming a network of mycehal threads about 3 microns broad

Another fungus that has been cultured from times imbricats scales is Endodermo phyton (Trichophyton) undicum Inoculation of this organism in pure culture has produced the disease

Da Tonseca has isolated in Beazil from a dermatosis called chimbere a species

which he named Trickophylon requestes. It is perhaps identical with T concentration.

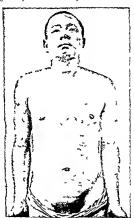
The characteristics of the geous Endodermophylon are. The growth of a mycelal network between the rete malpighu and the superficial epidermal layers in cultures only myrchal filaments are found there are no conidia bearing hyphae Conant (1940) thinks the genus Endodermo phyton should be dropped and the organism classified in the genus Trichophyton as in earlier years

When this skin disease is introduced into a country with high relative humidity and fairly uniform temperature between 80 and 90 F at apreads with great rapidity A dry climate or one showing considerable variations in temperature is not favorable for its spread

Symptomatology - The clinical characteristic of this form of ringuorm is the presence of rosette like lessons of several concentric circles of shingle like papers scales which are fixed peripherally and free toward the center thus from its imbrications suggesting the name given it by Manson

If one passes the finger over the affected surface from without inward there is no sensation of roughness but if passed from the center outward the free borders of scales cause a sensation of roughness As these circles extend peripherally they meet the peripheral rings of other circles so that various curves appear which give the general appearance of watered silk The flaky scales are of tissue paper thinness and are of a dirty brownish gray color The general health of the patient is not affected but the tching is very severe. There is an entire absence of inflammation about this ringworm thus differentiating it from the more common tropical ringworms Again the avillae and crotch are much more rarely affected than in other ringworms as is also true of the face palms of hands and soles of feet The scalp is never affected Some claim that the fungus never

invades the nails but Manson atates that this frequently occurs. The presence of the fungu in a scale treated with 10 per cent solution of sodium hydrate differentiates the scales from those of inchity osis. These intersects is somewhat similar to time ambricata when fir t appearing showing dark brown patches but it never shows the concentric rings. The ordinary ringworms prevent inflammatory characteristics.



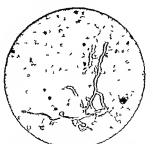
Pic 258 -T n a fimbr at (After Hengg le)

Trealment —A thorough preliminary scrubbing with soap and water in order better to etypose the fungs to curative applications is important Mansin recommended fooline luminent. This contains 13½ per cent of order as against 7 per cent of for the incture. The luminent has also 3½ per cent of glyceine which is not an ingredient of the uncture. Both tracture and himment have per cent of pots aum noded. The application of the tincture and mineral tracture and mineral thave per cent of pots aum noded. The application of the tincture does not seem to be as satisfactory as the luminent the stronger preparation being more effective.

Chrysarobin is very effective but very unitant and has to be used with care. An application of a 5 per cent solution of chrysarobin in chloroform



Fig #59 -Times imbricata in the skin (Ph ! ppine case)



F1G 260 -Trichophyton concentricum culture (Manifa)

to the affected area then painting it over with a 50 per cent aqueous solution of ichthyol often gives good results. Some prefer a 2 per cent to FUNGI 1175

5 per cent outiment of chrysarobin Chrysarobin produces a conjunctivitis if used near the eyes Again if absorbed it may act as a renal unitant The more modern preparation known as Cignolin (Bayer) may also be employed

Castellans strongly recomme das the use of resortum at facture of benzom (60 to 120 grams of resortum in rounce of intentures of heavans). Eather remody Jane has very little effect the combinations be egaces any. The supil calson is made once of the daily. In add from to this it is ment the patient should be scribbled with sand only and hot water twice a week. As regards prophylar we declaring should be to led or board. The nativest attend when in precentin the decase to amounting the body with

THE ASPERCILLOSES

Various affe tions of the skin (including the myeetomas) and of the car and lungs have been reported as aspergilloses. The Aspergillaceae family to which belong the very common suprophytic funge of the general Aspergillar and Penscullum frequently cause contamination of bacterio

logical plates and other cultures These colon es together with those of the yeasts mucors and spore bearing bacteria should he familiar to every laboratory worker. Just as the various species of the Aspergillaceae contaminate a plate so do they at times find a suitable soil in skin ear or lung lesions and many of the mycological authorities question the importance of these fungi as primary excitants of di ease. In this family we shall consider the genera Aspergellus Peniculisum Scopulars ps s and Allescher a In the study of cultures and m croscop cal preparat one of fun a it is assumed that the worker is familiar with the more or less round vesicle of Aspergillus with its phialides (sterigmata) and the chains of course branching off from them. In Penic II um these countial chains extend from a could ophore (approphore) which does not spring from a vesicle. It somewhat resembles the skeleton of a hand including the carpal and including hones as well as the ph I ages (rep esented by the chain of spores) Material for micro copical preparations is abundantly at hand in the patches of moulds on decaying fruits or vegetables as well as a contaminated plates. The very common blue g een mould a Penicultum P crustaceum Another species P breucquie when grown in material e nt ining aree ic produces a stro g odor of garbe and i the basis of a very delicate test for arsenic—1 in t 000 000 The very black moulds will in many meta ces show the fruiting hodies of Aspergillus niger A ors as saccharifies the rice starch (diastase) and in symbios s with a yeast produces the 15 per cent alcoholic drink sake of the

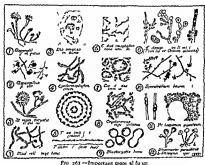
Other fungs of the 6 majy are of great commercial importance. In material from spitting pois real mental process around a proposition pois a spitting pois remained in the process of the proposition process. The product of the process of the product of the product of the product of the product of primary disease by any species of this group is not entirely convincing. 1 p. 2 flat furnity has been reported as re possible for an eptropet in piecons and piecon feede's has edveloped asperphious. This infection has also been reported as reported from a convenient of the precision of the product of the pro

The species of Pentallum which Tien g (929) demonstrated called lys st phylococcus c longes has been identified by Thom as Pe Il n lot m Westling It s probably a oil m uld The act ep mesple f th mould sas next solated a d as fou d to be freely soluble in wate a d was m d I menli a The substance has fr ved t be of exceptional value in the treatment of a number of cases of fulminating infect o Rep to I ave been made of it goat value in the te tment of I I ct ons prod ced by St philos ct s 1 5 P cers He 1st Streptococc x In general it is fi ctive against g am negati e ganisms cens E cept ons to this le are the Con occus and the Men ngococc 3 The results obtained in the treatment of go o hea with penicillin a c descr bed as spectacular. It is prep ed for a travenous use for intramuscular injections and for local use in the tre iment of wounds. It is supplied for the cal use as the sodium sait. (See also PP 333-376 1109a & 1175)

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The pulmonary infection is said to resemble phthisis but the patient generally does not seem to show an illness entirely comparable to tuberculosis. Haemorrhages are frequent and at other times the sputum tends to be blood streaked. Lases of asper pillosis have been reported with masal and corneal lesions in the latter case the injury has been from scratches by plant material A unguis has been reported as the cause of a mycos s of the great toe

Mood (1938) in a study of 32 cases of otomycosis observed in South Carolina iso lated sp cies of Aspergills from 31 and a species of Pensestium from one Gill has at 3 found a species of Uncoracea in infections of the ear. Mood believed that treatment



with a vaccine made from the infecting fungus lessened the discomfort and restored the ears to normal quicker than the usual treatment and that recurrences were less frequent

Mycetomas -- While tumors produced by fungi have been preponder antly connected with species of Actinomices yet cases have been reported by Brumpt and others where the findings were those of Aspergillus or Pencillium, and Negroni (1939) has reported the isolation of a species of Aspergillus in a case of mycetoma in Argentina While the evidence for pathogenic action of Pencillium is usually slight, this cannot equally be aid for Scopulariopsis which morphologically greatly resembles Pencil from Species of this fungus have been reported from cases of on cho mycosis Markley, Philpot and Weidman (1033) have reported the isolation of S brevicantis from a ease of vicerating granuloma and success fully inoculated animals with the organism Apparently this is the first case describe i in the United States S konings was reported from a gummatous lesson of the hand and in several instances from trench foot

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THE MADDROMYCOSES

STATE OF A
Definition —Mycetoma is the result of a fungus infection especially of tool and more arealy of other parts of the body. It is characterized by swelling and hypertrophy of the tis use resulting in a deformity of the part. The affection is chronic and recovery does not occur spontaneously Surscal removal or amputation is the only successful method of treatment.

Classification - Van Dyke Carter established the fungus nature of Madura foot a common affection in the Madras Presidency of India applied the designation mycetoma to the disease and Chalmers and Archibald divided my cetomas into two groups (1) Maduromycoses with granules containing large segmented mycchim with well defined walls and often chlamydospores and (2) Actinomycoses with granules com posed of very fine non segmented plaments with ill defined walls and no ehlamydospores They also recognized a paramycetoma in which the fungus did not produce granular aggregations. The maduromy coses have been separated on the basis of the color of the granules-black white vellow and red These grains may be embedded in the tissues or present in the discharge from the sinuses. Usually only one kind of fungus is found in a lingle ease. Brumpt in 1906 described 8 pecies but in 1936 he listed 48 species as capable of producing the chinical aspect of myectoma and suggests that there may be still others. He also divides the myce tomas into two groups the maduromycoses and the actinomycoses. In the maduromy coses he lists to species in 14 genera. The my celium of Madurella is septate and branches from time to time. It is much larger than that of Actinomices (usually less than In in diameter while the hyphae of Madurella are always above in and may reach a diameter of 8 tou I'vo case of white mycetomas have been reported as caused by species of Indiella-I mansons (India)

History and Geographical Distribution

History—The disease was first described by Kaempler about 200 years ago but at that time was often confused with elephantiasis. The first exact chinical description of the disease with its pathology in which was noted the fungus nature of the granules given off in the discharges from the sinuses was that of Van Dyke Carter whose studies were carried on between 180s and 1874.

Geographical Distribution —The name Madura foot takes its origin from the great prevadence of the affection about Madura in the Madras Presidency of India. It is also nedemue in other and widely scattered districts in India as Delhi Kashimir and Rajputana. It also occurs in Cybin and cases have been between the Octohic China (Perde de Cochin) Four cases have been between the Dutch East Indies by Boers Kou wenart Wolff (1988). The disease is rather wide pread in Africa having been reported from Afgers Tripoli Tunis Egypt the Sudan Aden

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Somaliland Senegambia and Madagascar Cases have also been reported from Italy and Greece in Europe and from the West Indies and some of the South American countries notably Agentina and in Cubs Sutton in 1913 reported a cases from Lansas one in a Merican and one in a native of Texes while Handan and Zurett (1918) a case in New 10st in a Hindu Boyd and Crutchfield have collected 30 cases from the literature

Etiology and Epidemiology

Ethology —The disease is caused by the penetration of certain species of fungi into the tissues of the foot as by puncture of a thorn or through



Fir 262 -Mycetoma (Visdura foot)

other abrasions. Rarely the hand or some other part of the body may be affected. The fungus develops in granulomatous areas from which saures lead to the surface of the foot in the discharges from which are found small granules re-embling those found in the discharges from actinomycosis lesions.

A very common infection is that due to Actinomyces medicine (Discounces medicine) which is a fungitis with fish root het granules of the pale or white variety of mycetoms. These like the fungus of actinomicoss Actinomyces bosts (Discounces bosts) show a felted my celium in the center and peripheral clib hie structure. The granules are yellowish white and vary in size from a pin s head to a small pea. The mycehal threads are very narrow 1 to 15 microns. The ends break up into ovoid condias 15 to 175 microns in size. The organism grows aerobically and the

cultures show slender myrehal threads which are Gram positive. It is not nathogenic for animals. This is the organi m of Carter's white mycetoma

Other species of the pale white or ochroid group of mycetoma fungi are Indiella manioni (Brumpt's white mycetoma) feiinomices aiferoides (Nocardia asteroides) (Muserave and Cleve's white mycetoma) Seriema o

cytts midulans (Nicolle s white mycetoma) and several others The cases caused by the black varieties are characterized by the pres ence in the discharges from the smuse, of black our powder like grains

The e hard brittle irregular grains are cau ed by various species of fun of which the most common is Carter's black mycetoma (Madurella micetom) This species was cultured by Wright and first shows a gravish growth later becoming black. Other black varieties of mycetoma are



due to very different fungs Bouffard's black variety is caused by Asper gillus bouffards DeBeurmann's black my cetoma has been reported to be due to Sporotrichum beurmanna (Rhinocladium beurmanni)

Besides the white and black varieties a red variety of mycetoma also The fungus grains are quite small and reddish in color not an uncommon infection in certain parts of Africa as Senegal. The cause is Actinomy es pelle tert

Boyd and Crutchfeld have noted an accompacte in an American case with white granules to which has been given the name Alleschiria boydis Negrons and Tey (1939) have reported the first case of mycetoma infec tion (maduramy cosis) from Argentina from which they cultivated Aspergillus chevaliers (Mangin 1909) Costa (1941) has reported the 4th case in Brazil

Trebed; and Mukherjee (1930) have reported 3 additional cases to the 32 which have been collected at the Medical College in Calcutta In 1180 MYCETONA

two of these the fungus isolated was the species Actinomyces modutes with the ochroid type of granules. In the third the species was apparently not identified

In recent years the organisms giving rise to both mycetoma and to actinomycosis have generally been classified in the one genus Automycosis in which some 70 species have been described. The characteristics of the genus and of a few species which have been isolated are referred to in the next section, p. 186.

However a number of fungs other than actinomyces have been described as espable

of causing the disease

Nito (tost) has reported a case in Argentina with white gains in which the orgasim soluted was classified as Vomosperium ghappernium. Shaw and NacCircge 1033 have also reported a case due to this organism in Canada while Almeda and Birbost report the violation from a case of unjections in Peranducio Ceptalospersia (Lino and Lato Lino and Lato. They note that this is the first case of my cetoms attributed to a specie of this genus.

Epidemiology —We know very little about the occurrence of these my cetoma fungother than in man. It is thought that such fungal lead a saprophytic existence on thors or blades of grass or spine like grains of various cereals. Thus hicelise a sees in Tuni

started from a puncture wound by a grain of barley

As the vast majority of such cases are noted in the feet and as such cases are chiefly in those who work barefooted it seems reasonable to consider that the fung are into duced by some puncturing object and the external wound having healed development goes on in the deeper structures

Pathology

In more than 75 per cent of cases of my ceroma the foot as the only part interested Rarely there is unoblement of hands knees and buttock. The affected part shows nodules on the external surface which connect with the granulomatous lessons of the interior of the foot by unuses In advanced cases there may be a network of snuses and cyst like distations which are filled with a vocid fluid packed with the small fish regranules in the white variety or with the gunpowder grains in the bladmy cetoma. The bony structures of the foot may undergo disintegration as well as the muscular and arcolar tissue so that on cutting into such a foot there is nothing normal remaining—often a cheesy may.

In the early granulomatous areas there are found the actinomy ces like granules surrounded by an area of monounclear and polymorphonuclear infiltration. Gank cells are occasionally found. There is a nullammatory oedema. Externally there are connective issue cells and a fibrous will. The blood vessels show endothciall problectation and thrombosts.

Visceral metastases do not occur

Symptomatology

The disease usually begins in the sole of the foot with the formation of firm swellings about \$\frac{1}{2}\$ inch in diameter. The cases are rarely seen at this stage, the natives waiting before seeking medical advice until the nodule has solitened and begins to discharge the viscid fluid with the various colored granules floating in it. As stated before the soft yellow ish white fish roe like granules are most commonly observed the root finable hard, guippowder like granules as a The nodules continue to from and to heak down until the foot has become greatly enlarged the

under surface builging out in a convex mas with the toes and heels appear ing as if raised. The dorsal surface is also puffed up and studded with broken down nodules and the sides well rounded. There is no increase in the length of the foot. This swollen distorted foot is borne on a thin peg like leg which makes the size of the foot more striking. Yery rarely cases have been reported where the hand or thigh has been involved if one probes the discharging anness home may or may not be fell according to the advancement of the degenerative changes. There is rarely pain or bleeding following the probing

It is more from the burden of carrying around this fungoid mass of a foot 3 or 4 times the normal size than from pain that the patient complains Uncomplicated cases do not show fever and the occasional enlargement of Lymphatic glands is probably connected with bacterial infections. There are never viscerial metastases in mycetoma as is true of the nextly related actinomycosis.

The process shows no tendency to heal naturally or under treatment but fortunately does not extend the process being confined to a foot or a hand. The joints are rarely if ever invaded. Unless the sinus riddled member is amputated the drain on the patient gradually exhausts him and death ensies in ten or fifteen years.

Diagnosis

The distorted appearance of the foot or hand riddled with sinuses dischriging a viscid fluid containing the variously colored granules which upon microscopical examination are found to be selective of fungi is absolutely diagnostic. As regards recognition of the eausative fungus one should culture the discharge or grains on maltose agar potato or rather dry blood serum. The recognition of these species of fungi is a very difficult matter even for an expert.

Prognosis

This is absolutely unfavorable as regards the relief of the condition but as regards life it i not unfavorable provided the drain on the system is gotten rid of by amputation of the part

Prophylavis and Treatment

Prophylaxis — The wearing of shoes in the fields or forests would seem to be the best means of protection against small wounds from thorns solutiers and the like

Then too any such wound which might occur should be treated with tincture of jodine

Treatment.—Cureting the leanon may be tried. As a rule the process goes on but is limited to the member attacked so that amputation of the diseased part brings about a cure. Iodide of potash is apparently often ineffective as is the use of thymol. Year treatment seems to be of value in relieving the piun and in lesseming the discharge from the singues but

is of questionable curative effect. It might be of greater value if tried early in the disease

ACTINOMYCOSIS

Actinomy cosis or fumpy jaw is a fungus infection of man or cattle caused by Actinomices bous (the Ray fungus) It is characterized



Fig 264 -Streptothrix madurae (V ncent) pink vari ty of mycetoma (Isolated by author Musgrave and

by the formation of granulomatous connec tive tissue and by multiple abscesses giving rise to an exudate containing characteristic veffowish granules

History -Bollinger (1877) demonstrated that the disease of cattle known as lumpy law and regarded as a form of sarcoma is due to a parasite which was named by Harz Actinomyces boys because of the radiating structure of the organism J Israel (1878) found the fungus in man and the following year Ponfick pointed out the identity of the human and bovine infection while Wolff and Israel first gave careful de criptions for the identification of the organisms encountered in the lesions

Any tissue or organ may be attacked Lesions of the head and neck are most com mon and occur in some 60 per cent of the reported cases The abdomen is infected in some 20 30 per cent often in relation to the appendix or caecum and the thoracic cavity in from 10-15 per cent

Kessel and Goolden (1938) have recently made a comparison of Actinomices strains recovered from human lesions in the United States They point out that some 76 species have been described as isolated from human lesions Some of these are described as being aerobic and some as anaerobic but in many instances the descriptions are not given in sufficient detail to be of value in actual classification Some consider the anaerobic

forms as the true pathogens and the aerobic ones as saprophytes Classification - Bergey in his Determinative Bacteriology (1939)

classifies the genus Actinomyces with Mycobacterium (tubercle bacillus) and Corynebacterium (diphtheria bacillus) genera definitely belonging to the Schi omyceles or true bacteria. He however makes the separation into 2 families (1) Mycobacteriaceae including the diphtheria tubercle and leprosy bacillus, and (2) the Actinomycetaceae In the latter family he classifies the genus Actinomyces

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The family of Actinomycetaceae is so widely distributed in nature (in the soil on plants and in the faces of mao and animal) and so important in biological processes that it careful tudy has been the province of hologists rather than those interacted in human or veterinary medicae and there has been rather general agreement among there has seen in the ground of pranquists the flood in a of invicology.

Characteristics—Actionopies resembles bacteria in many respects of which the following scale booted () The dam ter of the mycellat threads raving scarced as few alphy a too Bah (3) The sparsely and uregularly epitate filaments of Act monycet tend to break up into bacillary or exceeds forms. This fragmentation has been interpreted as exhibitopies formation and monespecies chains of spores are noted. The sporegenous hyphale frequently show a colling of several turns (savely exceeding it syntably Sache Viller and Sache Viller (Sache Viller) and the spore spores when the spore of spores. All spores are commotified of Garm posture is 50ms spores when grown on a fast containing model.

may show acid fast staining

It must be kept in mind that many of the attempts at culturing the acid fast lep osy
hacilius have resulted in attended by the fast lep osy
hacilius have resulted in attended has 1.4 finomyees) growth and Deycke a mastin (a

much vaunted cure for leprosy) was an ethercal extract of such a streptothriz growth

obtained by cultump leprous hodeles. In common with the most obtained by cultump leprous hodeles. In common with other mould contain mants of besternal plate cultures we itequately find leasthery very adarsent colonies of Admeny er which may be chally or shot various colours-yellow will take to green. When transiered such colonies give off a mental has been used one group requiring anaerob. Conditions for growth and the other growing under serotic environment. The pathogeness percess attaching to actionaryoes as in man or lumpy jay in estile (the farsel type) belongs to the anaerobic group. The requirements are ather those of spratial orge far cleans in its complete anaerobicum. J. If Winglis stressed the ances my for choosing as material for culture that which controlled the controlled the controlled that the controlled the controlled that which controlled the controlled that the controlled that which controlled that the controlled that the controlled that which controlled that the controlled that the controlled that which controlled that the controlled that the controlled that which controlled that the controlled that the controlled that which controlled that the co

Growth first appears one or two om below the surface. Easterial contaminants as frequently responsible for I there Growth is first noted as a small what especial for the days at 37 C. It would seem probable, that the are but up case at largely sarophyle: The Addings seem probable, that the are but up case at largely service. The there is the channel that he has addicted an are but carried to meeting the control of the cont

St epiothers Cospora and Discomices

Clubs and Granules —In the pus from leasons there occur the sulphur granules in a cintomy costs and the black (guppowder) ones in Madura foot Mycetomus caused by other lungs may show granules of a boars strely exceed 450m in diameter and are of a yellowish white color. The granules of A boars strely exceed 450m in dameter and are of a yellowish white color. The granules of I maduras are of an ochrond color and this specie is given see to white mycetoma. The lunguis of the black grain variety of mycetoma is Wadurella mycetom. These granules with bulbous structures set peripherally (usually called clubs.) Dodge considers these granules as bulbils (imail scieroits) Clubs are rarely seen in cultures. It is from the peripherally placed bulbous extremutes that we get the name. ray fungus.

Clinical Manifestations—There are four main types of actinomycosis in man—(r) Cutaneous where an epidermal le ion invades the conum and subcutaneous tissues producing a nodule which breaks down and dis

charges fish roe granules (2) Buccal In cattle the invasion of the jar has given this actinomycoss the name 'lumpy jaw' The process extends to the adjacent soft parts The tongue is involved in almost one third of these cervice-facial types (3) Usually secondarily to buccal infections we have a pulmonary type, usually fatal while the purely buccal ones which can drain freely generally recover (4) The intestinal type usually is in the region of the caccum and appendix (diagnosis commonly appendicitis) The actininy cotic lesions are generally free from pain Extension is by combinating—rarely by blood vessels or lymphatic channels. When enlargement of tributary glands occurs it is indicative of



Pio 265 — A timonyces granule rush d beneath a over glass showing rad altifulation of the hyal ne masse Preparation not stained low magn fying power (McPa land after Winght and Brown)

Actinobacillus infection The diagnosis of actinomy coses depends chiefly upon laboratory examinations

Epidemiology—Heating to 60 C is always fatal to these organisms so there is of question of a resisting spore as for anthrax. For many years the opinion was shell that infection took place by inoculation of some wound produced by plant material (as a blade of grass or a creat grain). In view of the fact that A given is a rather delical anascrobe organism and grows only at body temperature this infeas is unlenable. This much to indicate that actionopycotic financies may have as highest the consistence of
Laboratory Disgnosis — The fangus is to be found in the grainties and it is essential that culture or microscopical material be obtained from them. The purelest discharge may be poured in a thin thin in a Petri disk and search made for these mine the graining the properties of the purely of the purely of the purely of the cubis of the ray fungus. In issue sections Grain stain is sent instead light for the cubis of the ray fungus in a tesse sections Grain stain is sent in the method of culturing used by Winghl is noted above. Very substactory in the use of the capillary portion of a rubber bulb papette. The growth in this answer cannot can be satisfactorily observed tudor the microscope. Animal nocultation has not been

satisfactory as Homer Wright was not able to satisfy himself of actual multiplication in laboratory animals

More Important Species.-Dodge gives the characteristics and synonyms of 1 8

species of Admonisces with a differentiating key

A Bout — This openium is greenly completed the cause of lumpy jaw in cattle and a present in the solidor granules which are not heartercoate of the infection. The lumps which is present in luman actinomycos: see mix to have the same morphological and cubinal characteristics as that of cattle. As noted above it requires partial Often is on and body temperature for growth. The problem of citology is complicated by the frequent sizes called my the discontinuous continuous discontinuous continuous and the Ad mobically it is even maintained that in my of the pathological changes present may be due to these companion organisms.

A Modurae—Th's organism is the cause of white mycetoma (Carter or Vincent). The granules are white to yellow and the hyphae from a to 1 5 us to diameter. Authorn ties d as ree as to cultural requirements. According to R St. John Brooks it is a strict are he growing best at 37 C. but having a wide temperature range (50 to 40 C).

Dodge notes that it is a facultate c anacrobe but grows best anacrobically

A Alteroide — This is a frequent cause of white trian myselegeme in var. us partie of the world. Some authorities yeek to added any unrements as are materiolise—others as are but and still others as macrolus. This fungus was first reported by Epointer from a brain abores and apparently the same organism has since been reported from mysetonas in the Philippinese Drain Argentine and Europe as well as Asia and Africa Primping great as a Event posture from a dard resistant.

A Gypsosies — This organ sin was notated by Henner and Gardner from the sputum of a case of pulmonary mycoss. They noted its got that more rap d than that of the tubercle bacillus and that it was acid fast. For its recovery from sputum they recommended guines pig noculation. Whight could not assure himself of pulliplication of

Ad emices in guines o es

A Arrafol frus —This A 1 yers is given as the cause of cracked heels in Ind a (teratolysis plantare sulcature). It has also been found in acted ital erosions. It is a to be due to walk ng barfootod on damp so I covered ith manure. The colonies

on agar are pink or r ddish

A Minutus m is - This fungus has been reported as the cause of crythrasma (see

p 1165) Cultu es are frequently negative. When successful the c lom s on agar

ha e been reported as wase a d or brown and A Thu Hie s -- The fungus was studied by Pasteur and A senbach (883 884) Bergey classifies it in a separate Genus Erys pelothren Rosenbach. It was the birst lungus with which proof of immusity as obtained It seems to live say rophytically n fish. It causes a disease of pigs known as swine erysipel a which may be communic ted to butchers veterinarians or others working with this pig infect on. In Europe this disease if mire is serious economically but it is rather rare in the U.S. In Germany it is called rollouf and in France rour ! Besides the hop the d case may be a mmunic ted by other an mala especially crabs. Most cases in the U.S. have come from b ndling crabs or fish taken in the Chesapeake Bay region hum a disease erangeloid follows local infect on of a wound I the skin lin a day or two asw llen de predares with a bright red marg n appears. Although the usual type of infection is cutane us ea ely is may produce lymphang tis. Gi ndular enlargement may occur Rarely the infection may become generalized. The organism exembles th dighth rouls but is now classed with the Act nomyceteae Another n me s Ery p totar it is p th as and it was formerly call d B erverpelat ; tu cultu ed nd n ble med a sh wa filamenaous i rms wherea n broth there are nly t callary forms A pli of 7 6 favors growth The infects it 5 cms to confer a lasting immunity. An antiserum has been produced which my be injected into the region of the les on r intramuscula ly

Streptothricosis —The lesions described in man under this term have been suppurative and resemble those of Actinomycosis with the formation of abscesses and granulation ussue. The lung is the usual site of infection and there may be evidences of broncho pneumonia multiple abscesse gangrene bronchiectasis or empyema due to the fungus. In some instances metastases in the brain and subcutaneous tissues have been reported. Cases sometimes bave resembled those of pulmonary tubercu losis or pyemia. All the cases in which the isolation of a Streptothers has been demonstrated from the lung or sputum have died. The relationship of the genus Streptothers (Cohn) (Streptothers Coda) to Actionomics Cladothers and A ocardia is not entirely clear. The reported Streptothers infections unlike Actinomycous have been rarely about the head and neck. Bergey classifies these organisms in the genus Actinomics. However infections due to Actinobacillus are distinct and the organism classified in the Bacteriaecae.

Treatment—Treatment of actinomy could lessons is frequently unsubstactory. The most satisfactory treatment has been obtained in cases when the diagnosis has been made early when small easily accessible lessons have sometimes been successfully excised. In other instances curetage has apparently spread the infection

Full do es of iodides and also thy mol have been recommended for treatment but in man instances no favorable results have been obtained with these drugs

Lord (1937) and Cutil r and Gross (1940) emphasize treatment with \ ray irradications after radical removal of obviously diseased tissue

Sulfonamide treatment has especially been recommend d and ro successful reports and only a failure have appeared in the literature since 1938 according to Benbor et al. (1944) Hollen beck and Turnoff (1943) and Benbow recommend sulfad atme as the drug of choice. I vons however points out that long treatment is usually necessity.

and there is ever present danger of recurrence

Important prophylactic measures are the care of apical abscesses piorrhes and other dental and stomachic infections. Wo prompt and adequate disinfection show be given to punctured wound especially those in which fore in bodies have keen implanted. The medical treatment of Streptolius infections has all o proved unsate factors.

SPOROTRICHOSIS

Sporotrichosis is a chronic infection, usually limited to the skin, subcutaneous tissues and lymphatics occasionally involving the muscles bones ionits and lungs

This gummatous or ulcerative mycosis which usually follows the course of the lymphatics of forearm and arm generally starts from a thom prick of hand or phalanges. The causative fungt of the genus Sportrichum are widely distributed as suphrophytes. The family of Sportricheae is characterized by branched spatiat myclum. The sports which are generally single and never in chains project from the hyphac on short sterigmatio or are sessife.

From the standpoint of reported cases France and the US are the chief countries showing infection but this may be connected with more frequent sparsel for the fungat Other cases are reported from South America and Africa. The isolation of the fungat from a spontrictions feature was first reported by Schecken in 1850 If I H. Bulletini and lates on was recognized as a chinical entity by Bermanan and Kay mond (1902). The standard of the standard

traches a leasure one rever finds myreisom but only cagar shaped yeast like bod es phapes(s) it of in one citys. For daymos one should always culture the pass or step maps (preferably from an increased lesson). The colour fest appears about its second day and are recorogue preparations shows the arrows myreisom with porest (to all usually in groups at the ends of the hyphase. Optimizin it imperature is from 30 to 35 C. Spontentions is usually dangeoed as a publis or tubercule, but development of the less ons is more raised. There is also be effect on the general health as well as a lack of glandalist movelement. Carse of pulmonary sponter chosin have been rarely reported and also generalized infection. The lessons are usually confined to the deep parts of the claim or mucous membranes.

S bearmanns is the commonest species reported from plants. It fer ments saccharose but not lacto e. The spores are very numerous and often provided with short steriginata.

Five other pathogenic vaneties have been recently listed Wolbach described a species isolated from an arthur, of the knee which he named



ti oo -- sporot nos s Atri an n ti

Some ilmania Spontaneous infections due to S be ermined have been observed in rats dogs and horse. This fungur is unusual in its pitho genicity for both plants and animals. Bendam and Kesten have transmitted sporotricho is to carnations by moculation of the plants with the culture of S schenki derived from an intertion in man. The disease produced in carnations is a bud rot similar to that caused by the plant pathogen. Spoce After hiving saprophytically or para itically in plants. S schenki retained its virulence for animals. Zanser 11999 remarked that the successful experimental inoculation of barbary thorns accomplished by the e investigators adds to the evidence that plants may be a natural source of this infection for man and that the dic case may be contracted by puncture wounds with infected thorns or other pieces of plant tissue.

Laboratory Diagnosis -- Widal and Abrami have proposed an agglutination test- and others skin tests but the culturing technique is so simple

and satisfactory that it is given preference. An examination of the pus microscopically rarely reveals the cigar-shaped rods. A caustic potash mount is satisfactor; if the large bacillary forms are present but it is on the culture that one may have to depend for diagnosis Sporotrichosis is often associated with tuberculous Icsions. In the United States the majority of the cases some 140 have occurred in the Mississippi River



Fic 267 -Spo of a hum shnk Cultures on the glu ose p ptone agar of Sa bou and (Afte Gouge of)

Other cases have been described in South America Campas and Almeida have studied 12 cases in Sao Paulo Filho has named a species he isolated in Brazil Sporotrichum fonicce Also the writer (1930) isolated a species resembling S ben manns from picerative lesions of the arm in a case in Liberra

Dangerfield and Genr (1041) have reported to cases in South Africa 6 were in European miners the remainder occurring in natives From one mine there were 17 patients most of whom worked in one shall The rest all worked in one shaft of a second mine

Sporotricheae in Tinea Albigena and Mycetoma -A ship infection of hands and soles later extending to arms and legs seems quite prevalent in the East Indies The fungus is Aleurisma albiciscans A black grain my cetoma has been reported from the Soudan due to Trichosporium khortoun ensis

Treatment -Sporotrichosis when uncom plicated is rarely fatal. Honever if it is untreated at persists for months or for years Treatment with iodide of potash is usually effective The drug should be given in slowly increasing doses up to 4-6 gm or more daily Lord advises if it is not well tolerated by mouth it should be administered by rectum If absorption of nodules or abscesses is slow they may be injected with a weak solution of the iodide Ulcerated lesions may be painted with tincture of jodine Incision of the nod ules or curettage is not recommended as it ma) spread the infection \ ray radiation has also proved to be of value in

the treatment of the skin lesions Chromoblastomycosis -- Lane and Medlar (1915) reported upon a case which had been chinically diagnosed as verrucous tuberculosis. The lesions on the leg consisted of two small growths Examination of the first showed a small tumor in the skin outside the ischiatic tuberosit) It was about 2 5 cm by 2 cm in diameter purplish in color raised about 3 mm above the surface the top of which was slightly grayish in places There were a few gray scales on the lesion There was no discharge at the time of the examination The second lesion was one which had been previously operated upon It showed at the time it was examined by Lane a purplish slightly raised rather soft area about 2 cm "

TT80 PERMIT

freely movable and not tender There was a small, crater like opening in the center from which there could be expressed a slightly gray somewhat cheesy substance mixed with a little blood. In the microscopical exami nation however a fungus was discovered which was cultivated on the usual laboratory media and carefully studied by Mediar, and to which I rofessor Charter pave the name Physiophore verrucosa

Mediar found that the cellular reaction toward the fungus resembled very much a typical blastomycotic lesion. There was an inflammatory reaction varying from scute to chrome in type and a moderate increase of connective tissue. This process was most marked in the conjum but was also found to a shight extent intraemdermally. In the regions where the acute inflammatory reaction predominated the exudate consisted chiefly of polymorphonuclear leucocytes and a deposit of fibrin with an occasional endothelial leucocyte and eosinophile. As a general rule in some portion of these miliary abscesses one or more microorganisms were present

Pedroso and Gomez in Brazil in a case of verricous dermatitis iso lated a fungus which they considered identical with the one of Lane and Medlar while Terra in another case in Brazil proposed for the condition the name of chromo blastoms costs on account of the fact that the fungus gives in the tissues a distinct change of color. They classify the fungus they isolated in the genus Acretheca

Carrion in 1933 reported a case from Puerto Rico Several other cases of chromomycosis have since been reported in the United States inotably in Texas St Louis Missouri and North Carolina) and other cases have been reported in Uruguay Argentina Guatemala and the

Dominican Republic as well as in Japan Java and Africa *

Carnon (1040) has found other ca es in I perto Rico and has collected and compared a number of cultures. He believes that at least three species of fungi have been isplated from the different lesions. Harmodendrum pedroson Hormodendrum compactum and Plialophora verrucosa Conant has studied the genus Phialophara in the United States and con siders the funcus solated from a case in Texas as P verrucosa while Moore and Almeida who have studied the di ease in South America and the United States recognize as causative species of Acrotheca Phialophora Hormodendrum and possibly Trichosporum

Weidman (1937) points out the organisms isolated from cases of chromomycosis are only mildly pathogenic for laboratory animals Comes 1918 reported he was able to infect guinea pigs rate and rabbits with the organism he studied Brumpt and also Negroni report the species l'onsecoes pedrosoi as the most common etiological agent. Brumpt originally described this preces as a species of Trichosporium. It is as first cultivated by Pedroso in 1913 Brumpt (1936) lists the species iso lated in Africa as II ofgeriensis II lan grons and II rossicum in ulcerative lesions and II fontoynous in the squamous dermatomy cosis called by Fontoymont and Carongeau hode potss

on a Harringt n & Ba netson i ager ha reported o ca a occur ing in the Cruin of South Africa. From a of the the can it a lungus was t olated on had the charact s ill r wed mpdos the oth rana ts ela sticati n

The chineal descriptions in the different cases as described vary greally Moore and Mapother (1940) report a case in a man aged 67 the leave being confined to the face and consisting of a single discrete elevated pake is patch measuring 4-5 cm and elevated about 0 5 cm. It has fine as had a pearly appearance. The organism was found on section. Also a comparison of the lessons in Mediar and Lane 8 case with some of the case reported in South America shows very little clinical resemblance between them. Some of the cases have been reported as verticely administration of the cases have been reported as verticely dermatitis and others referred to as Mossy foot

Thomas (1910) in Manaos described a condition which he named mossy foot and the following year Breini in Australia also used the term to refer to a verrucous condition of the lower legs. No Jung were reported from the cases. The writer studied a case diagnosed as mossy foot in Manaos in 1928 but was unable to find any fungs in the lessons either in the study of films or in the histological examination or by culture. The term mossy foot is evidently an inclusive one and different case Staphylococcus albus was isolated from the verrucous non idecturit easiens and in stained sections of the tissue large masses of coexidety placed were found in spaces between the coarse connective issue fibers in the conum. Apparently the organism had a very low grade of virulence. Other cases described as mossy foot have apparently been case of tuberculosis verrucosa cutis. The condition also occurs sometimes in finance letter than the condition also occurs sometimes in faintant elephantiasis with secondary bacterial infections with occur.

Loenthal (1944) was consumed that his cases from Uganda were different being that ellephantisas with vertucous lymphanic determities which was regarded as due to lymphostasis. There was first velvety skin from chronic oederma, then vertucous population with beary filterm papillation with beary filterm papillation with beary filterm papillation with bear filterm was been perfectly as the second of the second of the form to the second of the second of the form to the second of the second of the form to the second of the second of the form to the second of the second of the form to the second of the second of the form to the second of the second of the form to the second of the second of the form to the second of the second

Treatment—Cases of Chromoblastomycosis in the United States have sometimes responded to codule therapy but Carron reports that in Pietro Rico they have been difficult to cure. The condition usually remains localized but one case has been reported with metastatic lessons. Emmon Hailey and Hailey (1944). have reported the cure of one man silter 3 months treatment by two exposures to x rays a fortnight apart followed by judice of potash increased from 30 to 50 minums three times a day. The man was subsequently Lilled in an accident so that prolonged observation was impossible.

FUNGI 1101

Visceral Mycoses —The invasion of the viscera by fungi has already been discussed under the different mycological infections. Pulmonary infection has been especially emphasused in Blastomycosis and Coccidiodal groundoms due to Cacadium inmitis and Cryptococcus githrists as well as in Iritimopiese. In addition Cristellan particularly in reported pul monary infections with species of Asper illus and Penicilium as well as with Vanilia as a cause of broncho-mondasas: In some of these cases which resemble pulmonary tuberculous but in which no tubercle bacili has eben found it is nevertheless suggested that the fungus may repre ent a secondary unfection.

At one period much attention was called as in North Africa (Algeria) to a form of spilenic myceos: This was reported upon by Pinoy and Nanta (1927). In a sense of cases the spleen was said to present char acteristic leasons which could be observed with the naked eye and consisted of nodules 1-2 mm in diameter of the color of iron rust. In later papers they reported that these enlarged spleens were indicted with a fungus which they first clay field as Steragmafecysis studious. Later Pinoy (1988) classified this thinguis as a new species Aspergillus nonder. Printer Weil and other investigators confirmed these results and reported that this jungus infection of the spleen was also found in France. A large number of papers were shortly afterwards published all confirming these results.

Obering (1928) in tenvestigating his collection of 200 apletus obtained by operation of autopsy reported that 24 of them were found to show my cotic infection and contained the characteristic hodules which had been reported to be of my rotic origin by Nanta and others. Later Langeron (1938) after reviewing the literature and studying certain cut tures 1 olated from cases of 30 called splenic mycoss concluded that there was no justification for considering that there is a mycotic form of spleno megaly. He believed that the funq, obtained in cultures from such spleens were accidental containmantions or non pathogenic forms and that the structures described as mixelial to character were due to pathological (1928) in Brazil McNec (1920) and the writer after further study of the duction were able to support the views of Langerin in

McNee in a most careful study of the clusters of Langeron.

McNee in a most careful study of the clustopy and pathology of forms of splenomegaly occurring in Great Britain noted the presence of typical fibrothe nodules in one type of splenomegaly. In these he confirmed the presence of abundant calcium in addition to iron and beheved that what had been described by others as fructification organs of the fungus were simply small round often double continued ma sys of calcium. He also observed peculiar light green or almost colories crystils in the modules and the small crystals were often joined together in a way resembling the segments of bamboo cames. He favored the view that they were composed.

of phosphate of tron

The writer has pointed out that in warm countries as Africa in instances in which autopsies have not been promptly performed there is

the possibility that fungi present in the intestine may pass through the intestinal wall and invade other parts of the body as the spices Such secondary infection with a fungus was demonstrated in at least a instances in autorsies upon wild animals

METHODS OF EXAMINATION FOR PUNGI

Similar methods apply in the study of pathogenic fungi and bacteria the objective being the separation of species or varieties either by isola tion of pure cultures or the observation of nathological effects in animals

As a rule the growth and appearance of colonies of fungs are more easily observed than are those of bacteria and the morphology more characteristic microscopically In the study of culture plates we necessarily become familiar with a great number of mould contaminants which we readily recognize at a glance Castellani has attached great importance to fermentation reactions but it is generally recognized by bacteriolo gists that many factors make such methods questionable in species determination. In scrapings from the skin pus from discharges aputum faeces vaginal discharges or van ous exudates the standard practice is to mount in a 5 to 10 per cent solution of caustic For dried scales and hairs strengths of 20 to 30 per cent are used Artifacts resembling spores or mycehum are confusing to caustic potesh mounts. One should familiarize himself with such artifacts in normal skin preparations. For pus aputum empyema find or various exudates and discharges mounting in Lugol's solution is desirable

Tribondeau a method is to treat the scales with either then with alcohol and finally with water hest put the sediment (it is convenient to use a centraluge) in a drop of caustic anda solution Cover with a cover glass and after the preparation has stood

about an bour run glycersp under the cover glass A very natisfactory method is to scrape the scales with a small scalpel and imen out the material so obtained in a loopful of white of egg or blood serum on a glass slide By scraping vigorously the serum may be obtained from the patient. After the smear has dried treat it with alcohol and other to get end of the fat. It may then he stained with Wright a stain or by Gram a method The ordinary Gram method may be used or the decolorizing may be done with anthre oil observing the decolorization under the low power of the microscope

Yeasts are best evanuated in hanging drop on a plain slide with vaselined ring

An excellent way to examine many common moulds is to seize some of the projecting sporangia from the surface of a plate with forceps and mount in hauid petrolatum Moulds in scales from skin or from infections of sanous mites or insects will show a growth in this medium when mounted on a slide and covered with a cover glass. The mycehum grows out from the body of the arthropod

For the microscopic study of moulds it is well to clear and mount them in lactophenol (carbolic and 10 cc lactic and 20 cc glycerin 40 cc water 20 cc.) This may be tinted with some dye as annine blue. The above is Amann a formula

Bodge recommends a z per cent aqueous solution of cotton blue a drop of which it placed on a slide and this is inoculated with the lungus material A coversup is applied and then plain lactophenol is drawn under the covership. A piece of filter paper at one side of the mount absorbs the aqueous solution and draws in the lactophenol drop on the other side of the square covership. The supravital blood staining method is of value in the study of pus sputum or exudates containing fungi

CULTIVATION OF FUNGI

Moulds grow well on media with an acid reaction so that by adjusting the reaction to +2 or even higher we permit the growth of the fungi but inhibit bacterial development

Glycenn agar bread paste or potato media are all suitable but the standard med a are those of Sahouraud

Conservation medium (for preserving stock cultures)

	Cit
Peptone	30 0
Agar (shred)	15 0
Tap water	1000 0

Differentiation media (two of these are used—a maltone medium and a glucose medium)

	Gm
Maltose	40 0
Peptone	10 0
Agar (shred)	5 0
Tap water	1000 0

The glacose medium is made by substituting glacose for maltose in the above

In such case the ingred ents are added to the sater and all placed in a cold autocla a and the pressure allowed to me in both outer and nerry cleck structurecouly until the treathed to pound. The autoclave is then shut off and allowed to cond down allowly When autoclave has cooled the median is filtered through obtoin tubed and then stend used the same as above. Upon removal from the autoclave the tubes are slanted and allowed to cool in this slant is consisten.

owed to cool in this slants g position.

The media is not titrated or the hydrogen son concentration adjusted in any way.

The media is not titrated or the hydrogen ion concentration adjusted in any v Sabourand claiming that the addition of either acid or alkali spoils the media

Some mycologista claim that the Saboraued med um contains too much sugar and that than interfers with growth and monphology. The mon satchardes seem to be more objectionable than the polysarchar des. Besides potato alants such voild med a may be mad from carrots in partial arb to stay (result or vegetable may be small fly propared. Some use sinces of raw fruits or vegetables of position in moust-chamber Petri dishers. Areas is must be neighly observed in a saking that else of raw fruits or Petri dishers. Areas is must be neighly observed in a saking that else of raw fruits or the same of
oe as i esh as possible and thoroughly sternized.

Carrot agar is used by many Carrot 500 agar 20 peptone o and water to make a
litre. Mushroom agar may be tried. Brain media bave a distinct value. The D ges
tie e Ferments Company sell prepared media, which have an advantage in tandardization formor in one feulture results from different laborations.

Bet re inoculating media with moulds some recomm nd placing the material in the alcohol for one or two hours to kill the bacteria. The moulds withstand such treatment.

In cultivating moulds small Erlemoyer flushs containing about 1/4 in of media on the bottom will be Jound suitable for the development of the colonies. In order to solitat the mould we may take the hair or scales on a screde side and cut them mot small fragments with a strick leads them mot an aphatumu loop from the surface of an agar it it touch a fragment with the loop and when it adheres transfer it to the first of the strick of the strick leads of the strick of the stri

Thut recommends Piece the mould material between two attenders glass slides. Seal one edge with wars a diplace the preparation in a most chember for four to seven diversion the foundation spread to the modern the Erleimeyer flask left dish containing several layers of thoroughly minutes the filter paper in top and bottom makes a satisfa tory moust chamber.

Hanging Block Cultures.—One of the best m thods of identification of moulds is to fill the concavity of a hollow si de which h s been flamed for sterilization with melt d

Sabourand sgar or other media smithle for monifs. The surface is then sociality with material from the colony to be studed and a famed (sterilo) over plus spide. In a similar method, which was deviced for the study of beaterial culture. But not or many suressor signs cut out from thests made by pointing method aprinto Petri data. Another method is to 1 to large drop of method again spical over a strole cover plass and then inconsiste the film of medium and adjust over a concrete side. These methods exceeding the property of the strong of media should be sufficiently and adjust over a concrete side. These methods assistated only with high powers.

For the study of the morphology of Monilis in cultures. Boggs used stab cultures in graph in the tube was handered in not formain the fairs cruded off and sections of the gelatin column out across at any desired level. These blocks were sectioned with the freezing microtione straned in distint agreeous furban (it to 3) the several hours then differentiated in saturated solution of citric and until nearly detoke reed. The sections were floated on sludes au-dired without blotting cleared in any and mounted in balasin.

For staining fung: in acctions of tissue Busse recommends the following method:

1 Harmatorylin to to 15 minutes then wash in 15 m ater. 2 Carbol fuching it is

20) 30 minutes or over might. Decolonize in alcohol for a few minutes then pass through absolute alcohol and xylol to mount in bolsam. The moulds are red.

The diagnosis of the mycoses is practically always a matter for the bhorison. The main dependence is upon the microscopic method backed up by culture. May every one of the parasitic moulds will grow aerobically though most six slow grows though though most six slow grows and the most of them price temperatures of from 2 to 30 °C though some of the most firmed parasitic grow better at 37 It is perhaps unnecessary to state that we should in studying any supposed my costs remember the ubuquitousness of sprophytic poor of fungs and that these may grow in etudates due to lesions resulting from the action of bacteria or proteoso

Diagnosis by Anthodies —The attempt to diagno e a mycosis by the demonstration of anthodies is regarded by many as unsatisfactor. Some of the moulds which produce deep seated or generalized infections may produce anthodies (agglutums, precipitins opsonins or myco) is must be upper layers of the sin (away from the superficial blood vessels) can do this. The chromoty of most of the mycoses would seem to lend support to the belief that ant hodies are not produced. Also, the ease of microscopic diagnosis makes the demonstration of anthodies for this purpose usually unnecessary.

However a number of antigens have been prepared commercially and placed on sale for diagnosis by intracutaneous reactions. Lessification should be a supposed to the control of the contro

Some investigators as Jacobson and Smith (1947), believe cocci dioidin is of value in diagnosis. Normal individuals, however some times react to it

La Martin and Smith (1939) report that antibodies can be found in the sera of patients heavily infected with Blattomyces dermatitids. A positive complement fixation test performed with a saline solution of Blatto

PUNCI 1105

maces of a 1 4 dilution of the patient's serum is distinctic of the disease blastomycosis. However they state a negative complement fixation test does not exclude the infection

Dermatids -In recent years a number of dermatologists have reported the appearance of lesions of the skin resulting from an allergic condition and have termed such lesions ids. Allergy is said to be the sine qua non of their existence Thus Sutton (1930) points out that during the exist ence of a trichophytid the trichophytin reaction becomes positive. The dermatophytids are fungus free lesions. When they occur they are regarded as the result of hypersensitivity of the skin to fungus products Thus it is believed that fungus free lesions on the hands may be an allergic response and occur as the result of an infection with the fungus in lesions of the feet. A number of dermatologists have therefore employed mocu lations of trichophytin for the diagnosis of the infection. However in recent years a positive reaction has been demonstrated to be of little value in many cases, since when a positive reaction has occurred it has sometimes been impossible to demonstrate infection with a fungus. Lewis Stoval and Almon believe that it may be of value sometimes in a pegative way in excluding trichophyton infection

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Chapter XLII

POISONOUS PLANTS

Practically every medicinal plant mentioned in the pharmacopocasis of the world grows naturally or can be grown in different tropical countries owing to the diversified climates and soils which exist in a number of them. Many of the tropical plants contain powerful and tone principles and these when introduced into the body of man or other animals may give rise to senious impairment of bodily functions or even produce dath. While the majority of the poisonous plants of the tropics which are recognized have been used as medicinal agents others have been employed for criminal purposes. Many of the less critized those use such poisons not only to fight their enemies, but to kill game and fish for food.

The natives of tropical countries possess considerable and at times a surprising knowledge of the effects of many poisonous plants while among the more civilized individuals poisoning by accident ignorance or intention is still fairly common However the number of plants by which man is commonly poisoned is not very large.

Livestock, may be possoned by a much larger number although by instinct such animals often avoid the most to uc plants unless forced by hunger to eat them The loss from possoning among cattle is unquestion ably very large in many countries. No figures of value are available in the tropics but in Montana and Colorado it has been estimated that loss to livestock by plant poisoning is in the neighborhood of \$200 000 000 annually

The alkalt disease predominating in South Datots and an affection known as blind stagers in cattle and horse predominating in Wyoning develop from the animals eating small amounts of selement bearing vegetation over a long period. However in blind stagers of the acute type the symptoms descelop after feeding for a short time on plants containing much larger amounts of selemin. Extensive hiterature on the subject of selemin possoning has accumulated during the past 10 years. Anyone interested in the subject may consult the articles of Trelease and Martin (1930) Beath (1937) and Moron (1937).

The chemical constituents of plants which are responsible for their toric effects may be classified in a number of groups

In which the substances are vegetable bases which include the amines and alka loads. In many instances these are of an intensty possionous nature. Some of the amines give a focial door to the plant and to some of the mushrooms their poisonous characteristics while the alkaloids as a rule give a latter tast to plants in which they occur naturally. This is itself is frequently a protection to man and also livestock which may come into contact with them. A great many medicinal drugs owe their 1108.

POISONOUS PLANTS

valuable properties to these alkaloids such as strychnine from nux vomica acontine from the different species of Acontium attornine and allied alkaloids from belladonna morbline from the poppy and recotine from tobacco

2 Another class of potenones substances found up plants are glucosides from a much larger group and are of more common occurrence than alkaloids. Many are intensely potenones but others are not towe. They also generally have a bitter taste and are employed in many of the plant extracts used in medicine. Common examples of tonce glucosides are neneude and cynama found in the Oleander family (1400-2000-2000 To Dug base family) and Digitalis (Storphidarizersee the Figurot family). In some instances as in the kee so of the forgione the plant may contain several plucosides of which digito in digitalism and digitions are among the most active and tour. Horses and cattle have been frequently po oned by eating the laxes of forgible as well as of species of Indian or American hermy of the Dogham care.

family
Another g oup of glucoudes important as po sons are the cyanogenetic glucos des
which contain hyd ocyanic soid is he him by be tiberated by enzyme occurring in the
plants themselves. These enzymes may betweet sufficient quantities of hydrocyanic
and in the samual hody to produce fairly results. A common substance of this date
that the samual hody is produce fairly results. A common substance of this date
(Usushaly) and a number of the members of the test and rogs families a number of the

(Wanner) and a number of the members of the tea and rose families a num wild cherries and prunes being a common source of poisoning (Couch 1934)

One group of glucondes (saponan) when shaken with sater produce a soapy foam They occur in a very large number of plants which are despersed in more than pot dier ent families. They are particularly po sono a to certain of the lower animals for cample fables, frogs and insects. Sone of them are especially employed by the natives in posioning fit. D e part in 1000 one of more parts of water may be fatal to the fit in which they produce parally as of the respiratory organs. In animals when taken by mouth they produce gration internal irritation vointing and distribute and they cause haemonylus when they come a to cont et with blood. Other common examples are species of the Sepindecese (Soapherry family) the soap out soap hark and 1000 roots.

A third group of possons consists of essential or volutio oils which often give characteristic tool on to the plants. Many of these are insect repellant for this reson but it is more instances in addition they are need credited. Common examples are those which are found in shuth (from sortmood Abit, it why which produces convulsions by its action on the nervous system or in eucalyptus with a campbor like oder and to some extent insect repellant. Others occur in the Fune family, the English and Januares yew heing particularly possonous when the wood bark, and leaves and the seeds are exten by suitable. However their elpoids of the berry seems to be families. An extent of the seeds of Argente e with which it is adultive to the support of the production of an engine or in the seeds of Argente e with which it is adultive.

As striking examples of the wegstable insectundes may be mationed pyrethrum obtained from the flowers and roots of Chry Hemmin enterary 3/6/1 u; and derive powder from the roots of several species of the genus Dr. The latter is used also especially in f b poiso ing and in New Guinea deriva root is commonly employed for succide.

4 Tous substances known as touth man occur for examp! a species of £ for & six and by us. There are specially blood towns and m y give nest to antitional on intravenous injection. They are responsible t times for considerable 1 set in the stock and more trately cases possoning in m n. Animals ho e e m y become more or less immu e if gr en small and increasing does of these substances in their food. Other species of Euphorhaecous shrubs as of the group € fraint or Jair phis which produce butts somewhat resembling smeet almonds contain phytotom s as current and not inferquently gr ense to possoning m.

5 Another group of poisonous ambatsuc a may be classified as reasus (before extraction) occurs g for example in species of th Berberdaceae (barberty family) especially of the gc us Podephyllum (mandrake) or i the fruit of Cut ulfus sol cynthus both of

which are sometimes employed as purgatives. Other examples are found in the species of the Cashew family sanduding Rhais leasted and will Highly tone, substances at another control as a convulsive prison a receised the general Rehedenderies or Kelmis and purctions a convulsive prison resembling strychame in its action is found in Anna to continue or Cectalis indicates.

The above examples should give some idea of the diversity of the more common torus chemical substances so widely distributed. Obvoods only the more important of these poisonous plants and the distributes they produce which the tropical practitioner is likely to observe can be discussed in this text book.

Arrow Poisons—Many primitive people add to the wound effect of their arrows that of poison Although annual secretions particularly snake venoms are used they are inferror in effect to the vegetable poisons. In some arrow poisons snake venom is combined with the plant extract but as the users often treat the snake venom in such a nay as to destroy the towns the effect must be due in such cases entirely to the vegetable poison. Material of hacterial nature has also been used particularly the testauts bacillis but most of the potent arrow poisons are vegetable.

Strephanthus is one of the most important of the Apornacea. Various species of this genus are used by Aincan in hes extracts being prepared from the seeds and often mixed with heads of snakes. At least two species are found in Liberia.—S summentain and S grains. They grow in husbes which produce striking pink pentacle like flowers. This poison which has been used especially for poisoning arrows is obtained by cooking the seeds in water and letting them exaporate to a syrupitarry mass. A small amount of segetable resun as sometimes added. The action of the poison is known to the medicine men and it is said to be used chiefly by them. Strophanthin is the active principle but the species S hispidus contains another substance known as pseudostrophanthin which is more toure to the heart mustle. After poisoning the virtum shreathing and pulse become gradually slower until the heart heats said denly cease. Frequently a convision occurs hefore death the heart being arrested in systole. In smaller doses the drug acts as a circulatory simulant.

According a smother important genus of the Apocynaceae vanous second which furnish a powerful posson. It is prepared by maung a decoction of the wood or roots and evaporating over the fire until a syrupy consistency is attained. * The gall hiadder of an animal is often added to the matter at it is to be punited over the heads of arrows.

The poison from the species A venenata known as outbain contains both an amorphous and a crystalline glucoside related to those in digitals. It produces very rapid death which occurs after rapid irregular heart beats rapid respirations and convulsions. Sometimes there is a great loss of muscular hower.

The sap and seeds of other species as Cerbera odollam and Therein nerifolis contain a glucoside theyetin which causes death from heart failure in 12-15 hours

Hygrevamus fale. le one of the Solanaceae is another poison employed by some of the natives in the interior of Africa and the Tuarees of the Sahara It produces symptoms like those produced by ourbain but it is not so powerful a posson, though it contains hy oscyamine and scopolamine

Stricknes -The principal arrow poison of the Amazon river tribes is curare made by extracting the bark of various Struchnes species Dr A Hamilton Rice in his studies in Amazonia found that curari is prepared from the cortex of a vane called Itary capo (genus Sirychnos such as S toxifera) the sheath or rind of which is macerated and traturated after wards houled with a small amount of water put into a tipiti press (made from the jacitara palm Desmoneus macroacanthus Martius) and allowed to exude slowly then boiled to the consistency of an unguent and stored in little pots. Into this curari are dipped the tips of the slender darts fobtained from the footstalks of the pataua palm Oenocarbus balana Martins) which are used with the blow pipes (zarabatana) last named made from the smaller paxieba paim (paxieba miri Iriariea seligera Martins) * Curan contains a sikeloids curanne and curine The former arrests voluntary movements by interrupting connection between the peripheral nerves and the muscles and the animal lies beinless on the ground while the latter paralyzes the heart. Certain Malay tribes use poisons from this genus but their arrow poisons seem to contain strychnine and brucine as well as curarine so that in animals wounded by such poisoned darts we have convulsive phenomena as well as the action on the motor end plates. In India, the species Strickness colombring is used also in homicidal and suicidal cases and is used for killing dogs rodents etc. It is also used as a fish poison. Other poisons used by certain Himalayan tribes have acomité as a base

The sap of Antiaris toxicaria is also used as an arrow poison in India and is a powerful cardiac poison (Chopra goas)

Atropheism -A disease of North China supposed to be due to the toxic properties of a weed tirsplex littoralis which grows in gardens around Pekin is possibly caused by a small insect often found on the weed as it is claimed the need will not cause disease if well washed before eating It is only in times of famine that the weed is eaten and then only by the very poor About 15 hours after angestion there appears itching of the fingers quickly followed by swelling and discoloration. This swelling extends up the backs of the hands and outer surface of the forearms The face also becomes swollen so that the eyelids may be closed and the nose becomes cyanosed and cold. The swollen parts may ultimately develop blisters and ulcers Later the finger tips may become gangrenous the face and evelids evanotic and oedematous. Sometimes the cases resemble Raymand's disease. Usky has recently described cases with these symptoms after eating leaves of this plant and he believes that the cutaneous lesions may be ascribed to a light sensitive dermatitis. Some

Unitered mer and Dutcher (1942) have obta ned Curare in crustall ne from from the vine (& adod ad a tomentasum (Science tour)

which are sometimes employed as purgatives. Other examples are found in the species of the Cashew family including Rhis toricodendrum. Highly totuc substances and andromedotoxin are found in species of the general Rhododendrum on Kalmes and species of the general Rhododendrum on Kalmes and species of the general Rhododendrum on Kalmes and specialistic of cocculius of

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Strophanthus is one of the most important of the Apocynaceas Various species of this genus are used by African tribes, extracts being prepared from the seeds and often mixed with heads of snakes At least two species are found in Liberia -S sarmentosus and S gratus They grow in bushes which produce striking pink pentacle like flowers This Poison, which has been used especially for poisoning arrows, is obtained by cooking the seeds in water and letting them evaporate to a syrupy tarry mass A small amount of vegetable resin is sometimes added The action of the poison is known to the medicine men and it is said to be used chiefly by them Strophanthin is the active principle, but the species S hispidus contains another substance known as pseudostrophanthin which is more toxic to the heart muscle. After poisoning the victim's breathing and pulse become gradually slower until the heart beats sud denly cease Frequently a convulsion occurs before death the heart being arrested in systole In smaller doses the drug acts as a circulator) stimulant

Accombine as another important genus of the Apocyaneae various species of which furnish a powerful poison. It is prepared by mining a decoction of the wood or roots and exaporating over the fire until a syrupy consistency is attained. The gall bladder of an animal is often added to the matter if it is to be painted over the heads of arrows.

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species of Airiplex are said sometimes to become poisonous through the absorption of selenium from the soil (Muenscher 1939)

Lang (1940) points out there is much that is obscure in regard to this subject. He observed that it occurs in those eating the food who have had no part in gathering it and hence that it is not due to the small greenish yellow mite that is often found on the plant. The symptoms did not arise in those who had eaten atriple unless they exposed themselve to bright sunlight and since the lesions appeared only on exposed parts in thinks the immediate cause is irritation due to the sun's rays though the question of sensitization to sunlight by ingestion of the herb needs consideration and study.

Cannabis indica occurs especially in India Persia and Arabia It is the cause of a pernicious drug addiction in Central Asia and the plant is generally called Indian hemp In India the forms of the drug generally used are gangah the dried flowering tops which is smoked mixed with bhang a mixture of the dried leaves and capsule which is tobacco made into decoctions and is the cheapest form of the drug and charas the resmous exudate obtained from the cut female heads of the plant This is the most expensive and most concentrated of the preparations In Arabia a confection is made from charas and is known as hashish It is sometimes mixed with extracts of different Salanaceae such as datura and nux vomica and in this form is said to be taken daily by millions of the inhabitants of Africa and Asia although stringent regulations against its sale have been taken in some localities. The drug gives a feeling of well being followed by hallucinations of sight and hearing-often of sensual character This is followed by dimness of vision drowsiness and stupor Addicts may become insane Chopra says that in India Cannabis andica is often spread upon the beds to drive away bugs and is also used as a fish poison in Bengal

bearty meal of beans be began to feel very ill and two hours later on word ng urme noticed that it was black. He was of the opinion that the beans be had eaten were from Sirily Fave days later be was admitted to hospital showing ashen gray color of facies and pallor of mucous membranes which was accompanted by jaundice. There use some lever and the prime was absolutely black (hasmonlobinging) and showed many granular casts. Red cells were about 1 400 000 and the haemoglobin 38 per cent The leucocyte count was 10 300 with 73 per cent polymorphonuclears Reticulocytes were about 14 per cent. There was about 12 per cent of crythroblasts and rather marked anisocytosis Blood urea nitrogen was 37 Paroxy smal haemoglobinaemia was excluded by the Donath Landsteiner test. (The patient had a positive Wasser mann reaction) A skin test showed ellergy to an extract of the heans eaten. This case was apparently the first to be reported in English or American Interature. On account of the great number of Italians have un the United States it must be that the allergy described above is not frequent. In Italy it is noted that the attack comes on shortly after exposure with an irregular fever and haemorlobinuria. The sudden and great fall of red cells may cause death in a very short time When the patient does not de recovery takes place satisfactionly. Epithephria and blood transfusions are to be considered in treatment. Neuenich does not list any species of list a native in the United States so that the beans eaten by the different patients were p obably imported In India I a a str a has been shown to contain bases with alkal idal properties which have been named vicine and divicine Robinson (1941) has observed 6 cases in Palestine in all following the eating of the broad beans acute haemolytic anaemia was present. The first symptoms were vomiting and diarrhora The skin turned pale g ey The ur ne was reddish brown The cases were first in a taken for those of Lederer a anaema. The disease is especially common in Sardinia and S city The morbidity rate in Sardinia is as high as 5 47" with a case mortality rate of 800 Kere or Yangone -An intoxicating (n is alcoholic) drank is made from the root

Kara of Yaqiyan —An indonesting (no a technol c) dinch as made (som the root or leave of the proper plant F p "medys' care a dis a ceremonal because the secrety of the shadow of the South Lock. The pass of the plant is a ceremonal because it is a common of the state of the proper plant F p and the plant is a ceremonal because it is a common of the state
Lathyrism is a disease characterized by nervous manifestations a form of spastic paraplegia and there are symptoms of neakness and muscular pains without psychical disturbances It is common in Abyssima Algeria and India It has been believed to be due to enting in times of scarcity of bread made from the flour of the chick pea Lathyrus sats us or other species of vetches. The disease comes on insidiously with pains in the back and weakness of the legs. As the affection develops the legs are dragged along with great effort and there is a tendency to fall. Wasting of the leg muscles is common Reflexes are exaggerated Incontinence of unne and loss of sexual power are smportant symptoms. The upper extremities are only rarely involved. There is no mental or cardiac involvement. The disease runs a very chronic course but is rarely fatal. A deficiency in vitamin A has been suggested as a factor in the production of the disease. In India this plant is known as Ahera i dal. It is an important article of diet for both man and raimals in most parts of India and Chopra (1940) emphasizes that a large number of cases of poisoning are due to it lie says examples of lathyrism in man in the form of spartie paralysis are commonly seen every day in the streets of Calcutta. While Cannabis Sativa —Marihuana, is the name given in Meuco and the United States to the flowering tops of this hemp plant, a member of the flar family widely cultivated in the United States and elsewhere for its fibre It also crows wild as a weed

The flowering tops, especially those from the pistulate (female) plant are smoked in India under the name gangah. In the United States hemp cigaretites bear various names besides marihuana—as reclar muggles the weed etc. In some instances an extract is made of the tops and used to impregnate tobacco urgareties.

The use of marihuana seems frequent in underworld resorts and his been reported among the better social classes. The dangers attending use of the drug especially by young people in the public schools was first emphasized in New Orleans about 19 0 and a Federal law making the use of Cannabas illegal was passed in 1937.

Herona or other derivatives of oppum have been added to the man huana in order to create oppum a ldiction for apparently true addiction does not follow the use of cannabis there not being clearly demonstrable

tolerance increase or withdrawal symptoms

The intorication which may arise from the smoking of a single of rette and may come on in an hour or so is characterized by extirement mental confusion talkativeness and often spells of hysterical laughter Visual hallucinations and sexual illusions also are features of the interaction. Many of the cases treated in hospitals are neurotic that type of personality being given to use of the drug for the pleasurable phases of its action. While cuphora is exprenenced, there is at the same time an annuety complex which may lead to deas of suicide.

Many cases are cited of homicidal attacks by persons when under the indication at Bellevue Hospital, questions whether it preliapout to time noting that no cases of merder or sexual came were established at due to mathiana in 67 trails in the U S County Court of General Sessions. Nevertheless there is general agreement that marihums cigaritie smoking brings about weak-leaning of restraint and inspariment of Judy meals, and it would seem that the excitation of sexual illusions might well lead to sex crimes. In his books, Marihumai' (1938), Walton states the situation is of the utmost gravity and is one which calls for drastic measures of eradication?

ures or cramication

Farsim.—This is a discase caused by inhabing pollen from the flo or at of the bran plant or by earling the h at (it an afabel—most ferepers in flat) and is peculty southern Stoly. Heredity seems to play a part, some families ming a history of fating over many generations (floosyneraly). Plagration of rare beans in one part to case? that eating cooked beans About half of the cases are due to exposure to holomost plants. There exeems to be no relation between the amount of bean eaten and is secretly of the symplome. The takes in connection with the hypermensitiveness to the holomous doubt surely indicate some form of allergy shout 8 per cent of the case are fatal. VicCine and Ultry (1933) reported a case in Philadelphin. The patient at L2 and agac a halt ya of attack from per biomass when living or Sixtly Follower's

diets were deficient in vitamins and proteins. Lethymis interns grains are meth in proteins but deficient in tryptophan. In his cases, he suggests the condition may be due to tryptophan deficiency and that hence symptoms of this nature may occur in the absence of this water figse Chap. XXXII on Vitamins). Action and Chopra concluded that lathynism is not due to Lathymis instead to the contaminating weed lives sixtle and that the toric puniciple divisions was found in this contaminating weed. It was ser regarded as closely related to barbaturic act. They believe that lathyr ism occurs when the ordinary food Khesan dabl is contaminated with the white kit. Chopra (1958) apparently does not believe that the cryet mental proof of the actual factor responsible for the production of lathyr was has been demonstrated.

Milk Sickness —Cattle eating individed (white snakeroot Eugalorium ageratodet or Uritace falium) in the castern. United States or rayless goldenrod in Texas († 1/pappyus keterophylius) acquire a serious disease called brembler or in some instances alkali disease or milk uckness. In man there are observed anoreum anusea and vomiting which prevent the taking of food and water and soon bring about an acideous character used by a high mortality. The later symptoms are subnormal temperature ettiemely low blood pressure presence of disceite acid in the urine and of the odor of acetone in the breath and urine. The blood shows a marked ketoss a lipaerma and a hypogly caerma. The possonous prin ciple of Lupatorium and 1/plapappys is tremated one of the higher alcohols and is found in the leave a and stems (Couch 1011).

Vomiting Steleness of Jamaiera, or Alee Poisoning ~This is an acute and often fatal disease common in the West Indies. It is due to eating unique after or acker the local name of the fruit of Bighen sephal. The fully ripe opened fruit is harmless and is a valued food. Children cating the unique fruit with abnormal anili which may contain the poison become suddenly iff in about 2 hours with abdorman! pain and comiting. There is a period of apparent recovery lasting a few hours after which vomiting again begins and almost coincidentally convulsions and come anding generally in death. In eather periods it was sometimes confused with vellow fever. The disease has attracted wide attention in Ilamaica for many years.

Scott (910) has studed the affection f a long period and say, that acre dong t hutors more than got persons to one idented the We I find a very central fill yell. Apparently the tree was not originally found in the West ladders but was introduced there in 1716 from a West Almost Max 1811. The course of was go not the tree to the institute of 1716 from a West Almost Max 1811. The course of was go not the tree to the institute of the Cold Coast while the local name of the fact there is no the New York Cold Coast while the local name of the fact there is no the New York Cold Coast while the local name of the fact there is no the New York Cold Coast while the local name of the fact there is no the New York Cold Coast while the local name of the fact the course of the Cold Coast while the local name of the fact the state of the Cold Coast while the local name of the fact the control of the Cold Coast while the local name of the fact the control of the cold Coast while the local name of the fact the control of the control of the Coast Coas

reported from there was. He who exast he us do this has how to remove the posses. The class been a grant deal of decisions of easiers, yet as to the amount of somit my archives caused by the largestim of the above front. Soft how has collected very convincing evidence of a finishing examinal path in goal and spreamental nature step convincing evidence of a finishing examinal path to the convincing examination of the convin

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moderate amounts of this pulse can be taken with impunity when large amounts are taken, especially to the evolution of other foods the unfavor able is implomed develop. Altrichin (1940) has studied a sense of 21 cases between 19-45 years of age all of whom but one were males with symp



Pic 268 - Blighia Sepida koen Ake

toms of spastic paraplega with refeation of abdominal and cremattanc reflects and no setsions; changes. They seemed clearly to be casts of primary lateral sclerous and by clumnation; the syndrome was seen to be identical with that of lathyrism. He however says that Lathyrism satures is not consumed by the inhabitants of South India but that the There is a wide spread entirely erroneous belief that if a silver coin is put in the dish in which mushrooms are cooked at will be tarnished if poisonous varieties are present. They can not be recognized by the taste-the most poisonous st ecies are said to have a very agreeable flavor. In Washington an Italian officer who was regarded as an expert in the recognition of edible species purchased in a market some mushrooms which had been collected in nearby Virginia. He breakfasted on these mushrooms and spoke of their fine flavor. In about 15 minutes he became acutely ill developed blindness dysphagia and convulsions and died within 24 hours. If one has not the emert knowledge required to identify the species with cer tainty one should eat only mushrooms which have been passed upon by a competent (preferably official) inspection. Even in cultivated beds poisonous species occasionally develop

There is marked individual variation in susceptibility. In the case of a family of 6 poisoned by Imanita nappa reported by Bentkowski four died (one of whom had eaten only a mouthful) one became ill but recov ered and the sixth who had caten heartily suffered no ill effects

In the United States most cases of poisoning are due either to Amanila muscaria the dy amanita or to 1 phalloides the death cup Both species are widely distributed and very common. One feature which helps to identify this genus is the persistence of a portion of the veil energing the stem a little below the cap

The poison in i muscaria is muscarine an alkaloid related to pilo earpine This type is distinguished by the early appearance of symptoms (within three hours) and death in the fatal cases occurs within 24 hours There are nausea vomiting diarrhoea severe abdominal pain aweating salivation tachrymation missis often a slow irregular pulse and in fatal cases convulsions and coma Atronane is an efficient antidote and although the symptoms are violent the mortality is low (about 10 per cent) in properly treated cases. The Doison in I phalloides is a toxin. In this type the symptoms are

late in appearing (6 to 18 hours) and although the mortality is from 50 per cent to 70 per cent death usually occurs only after 5 to 8 days. In addition to the gastrointestinal symptoms noted above there may be great thirst anurer jaundice (after two or three days) cyanosis drowsi ness delinum or coms. There is degeneration of the renal tubular epithelium and liver necrosis and extensive degeneration of the ganglion cells of the cerebral cortex basal gangha verebellum and brain stem have been described (Vander Veer and Farley 1935) Viropin has no effect In antitorin has been used in Furope with alleged good results

Another rarer type of mushroom poisoning resulting in an acute baemolytic anaemia haemoglobinum and saundice has been described

becovery is the rule

There is little information available regarding the poisonous fungi in most tropical countries. However species of Amanda are not uncommon and in India at least one of these contains the poisonous principles of amangine and muscause

in which the ackees have been cooked is thought to be much more tone than the cooked fruit itself.

Jordan and Burrows (1937) carried on an extensive study of the affection in Jamaica. They found that the seeds were the most proble source of the poisonous substance. The mocuous nature of normal anili was and cated by their wide consumption by the general population with no ill effects and they were unable to detect the poisonous substance in this portion of the ackee by feeding it to cats and monkeys. But with abnormal fruits such as those which were unripe and that had hung upon a dead branch or had lain upon the ground while some of these were not tone extracts of their seeds proved markedly touc to cats. They found last the seeds and pods of both inpe and unripe ackees contained a substance which upon ingestion induced violent vomiting in both young cats and Macaeus rhesis; monkeys. Their evidence suggested that the ackee posson was a glucoside.

Evans and Arnold (1938) have performed careful chemical studies upon the akee fruit and have separated the constituents into saponin fat and phytosterol and demonstrated the torucity of the saponin

Scott had long ago suggested the towe principle might be a gloroade but mirrly on the ground that the posts or could not be obtained from the gastire continue for tusies or extreta of fatal cases and he inferred threefore that the tome agent was some authance rapidly decomposed or changed on absorption. Evans and Arnold post out that cases of akee poisoning more commonly occur from December to Februaryor March and they have absorn that in three colder months of the year the superior content of the skee is higher and the towardy greater. By careful tests they have shown that the normal naturally opened akee is harmless whereas the unoposed is as highly torue. The arillus of the unopened sixe was the short that the company of the state of

The toxic property is cumulative when repeated sublethal doses are given at daily intervals. The arilius of the fully opened akee is not lethal to guinea pigs. The postmortem findings in both kittens and guinea pigs indicate an active toxicimia affecting all the organs with hiemorrhages and fatty changes chiefly in the liver and ludoeys. The saponin found in the arillus of the unopened akee is strongly haemoly tic nonhaemoly tic in the arillus of the fully opened akee and only slightly haemolytic in the partly opened akee.

It seems however quite evident that there are many cases of individuals with symptoms of vorniting sickness in Jamaica in which the disturbances may be due to the ingestion of other irritating or even poisonous foods.

Mushroom Poissoung—The best known edulte mushrooms are (in England and the United States) the meadow mushroom Agaricut can pester which grows only in open pastures and (in France and Italy) the champignon Marasmuss oreader. There are no criteria by means of which edulte mushrooms can be distinguished from possionous varieties. pedum upp apurges Euphorbus app and the cultivated printives. Certain plant of the pinnorse family as the specied? I must de-boxes are not to cause a detentative especially when the printiples are in flower. Left prashs a dermatitis caused by handling various bulbs or statis. Those handling the wantle baces may suffer from an technique to the contract of the contr

In Japan the lacquer from Rhus or use fera causes a skin oedema affecting the face

and extrematies which is followed by a papular eruption

Among a deces (Meng from)—Kurby Smath (1938) has called attention to the fact that a form of dermatute spectrally of the hands near and face particularly of the lopis, may follow cating mangest. These symptoms and burning and ticking may appear to 8 hours after that magnession. The sink or rand at the fruit as well as the appear to the spectral of the state of the spectral of the spectral of the people realize that the rand a writating to the nucleus membranes. Some individuals are altergo to manges as nother are to strawberring.

Ginger Paralysis (Take paralysis) -- From February to April 1010 attention was drawn to mysterious outbreaks of paralysis in certain parts of the United States especially Cincinnati and Tennessee Male adults were chiefly attacked and all gave a history of drinking Jamaica ginger one half to 3 weeks before the attack. The most striking aymptom was a flaced paralysis of the distal muscles of the limbs without involvement of the sensory nerves except for a feeling of numbness and aching of the calf muscles preceding actual paralysis which usually followed after 3 or 4 days. In other cases the arms later became involved. The knee jerks were usually increased the plantar reflexes abolished in some instances the flexor muscles were found to he weaker than the extensors and there was subjective loss of strength. Cases were later found in Oklahoma in February 1930 By the end of April over 500 cases were detected and it was later estimated that there might have been in the neighborhood of 1500 cases. Outbreaks occurred also in the middle and southwestern states. In southern Cabiornia there were 124 cases and 316 were admitted at the Cincinnati Hospital Others were reported from a number of the southern and other central western states

The desses was regarded as a type of polyneumia of modernmaned cause. It was suggested in Boston that the partials so supple to be regarded as an industrial scientia and the condition was searched by some of the patients to thur work being performed on damp and rold floors or to working in dealth. Desth occurred in some instances and was thought to be due to respectively paralysis. An examination of the nerveus inconserverself dependance of the relations reverself dependance of the metal ultrar scattic external pophical and sections and participate that settled approximated the number was not found to settled up to the conserve roots. Later studies estimated the number was not found to settled up to the conserve roots. Later studies estimated the number of the studies of the

The cause was eventually found to be due to the consumption of adulterated Jamaica ginger which contained a per cent of inorthocress) phosphate (Smith Etwore Valuer France and Mallory)

Later investi

Other known possonous species of this genus in India are Amanie mission (gl. agatte) and A paintherisan exacted again.) Still other common pusioning one are Strophiere semiglabital Hypholosing Jauszellares and Laufe see otheres. Lepiate mission (cerested again.) and several other agrees of Lepiata regraried with su pions. Chopp points out that Paulholo auditoderms the yellow staining mustroom has caused librar in some cases. I olic in gloscophols (the glutinous again, and related species has always been regarded as possonous. However Choppes any, there is recent evident that shows these may be estern without it effects. He points out that the number of species that are poisonous is comparatively few to the number eaten widely in India Ite remarks that if they are first inaccrated in winegar before thorough cooking and caten with plenty of bread few are dangerously possonous as the poisonous promptes destroyed at 100 C.

Ergotism is another well known illustration of accidental poisoning from the ingestion of food plants rise or other cereals normally whole some but which have become contaminated with the fungus

Plants Causing Dermatius Venenata—There are a great many plants in various parts of the world which cause various types of definitive enythematous vestcular or autucana! The best known of these plant belongs to the Rhus family. By far the most common cause of plant dermatities in the United States is poison by Rhus toxicodendron and closely related form known as poison oak. The poison sumac, Rhus serius in the northeast and poison wood. It is possion sumac, Rhus exiting so southeast produce similar and often more severe demaities (Muenscher 1939). For poisoning with these plants it is necessary that contact be made with the plant—the idea that a volatile principle is given dis is not true. The exciting agent is toxicodendrol and it can produce dermatitis in susceptible persons in exceedingly small quantities of a milligram.

Repeated attacks do not seem to confer an immunity. Following exposure the sin about be washed and scribbed with soap and water. Alcoholic solviuous or old ones spread the inflammation. Striking tentits have been reported following administration of posion my and posion oak estracts. These extracts are solutions as a vege table oil of a substance extracted from the fresh heavys of posion my and posion oak fresh that the property of the position of the positi

more urritating when wet than when dry

Reuter and White (1941) have studied the susceptibility to and latency of poison

the contains. A nection are suppressed to the containing the and mobbed mined and whole district any of the containing the con

A large number of other plants are capable of causing dermatitis in man in the limited States. Among these are the parsaip Pastinaca set to lady slippers Cypri

volunteer convicts in the Calcutta jail 6 persons who were given suspected oil developed characteristic symptoms after 5 or 6 days while the controls remained healths.

Lal and Roy in Cakutta also conducted feeding experiments on as healthy young subjects and on the fifth day symptoms were moted con usting of fever and orderna of the legs. Haves believed the essent al substance in mustard oil poisoning is ally! nothiocyanate and believes changes in the oll take place when it is cooked at a high temperature Chopra and Badhwar (940) point out that in some of the epidemics the mustard oil was adulterated with hotohor oil from seeds of 1 g mone mex cano the Mexican poppy or 18 alkata Experimental work on human volunteers showed that food cooked in oil containing known quantities of A gent is oil produced symptoms of gastro intestinal irritation oedema and cardiac involvement closely resembling those found in enidemic dropsy. The artive principle present in this oil has a cumulative flect and provided sufficient quantity of the oil is consumed as imptoms appear even though the consumption of the A gener oil or incriminated mustard oil is stopped The seeds of t g mone m re no resemble superficially mustard seeds Lal (ost) and his associates have continued their investigations upon this subject and have described a meth d for solating a substance which will indicate the amount of A remone Oil p esent in Mustard Oil They believe that the toxicity of the oil corresponds with its content of this substance. They obtained the substance in crystall ne form and gave it the empi ical formula of C II iO . They have also demonstrated that it has a o sonous effect when add d to the basic diet of rats. The oil after removal of the crystalline free base on exposure to light becomes buildy anattive but adm hist 2 tion of the white crystal substance resto es the toxicity. Cont I rats fed on pure mustard oil showed no poison us effect. They has e performed three feed ng expen ments with a small number of ofuniters. In the e experiments the control group I no they state proves the past taken by Argemone of a causing sp demic if oppy but the actual t ric principle has not yet been determined since fracti na of the oil have not near d to see

The sympt ma of epidemic dropsy and the pathological changes observed have been discu sed fully by Shattuck to Chapter \\\

The diffe entiation of this form of epidemic diopsy i m the oedema noted in Central I grope and Fernt during the World War may be difficult the latter any arently being a deficiency is ease. In cases in which the eight deficiency of the albumin contained in the blood in so demic d pay egg and milk albumin g en in large quantities are ecommended for treatment. Thy to destract bus also been recommended and uncture

l'ephedra o-30 n nime with calcium factate to grains tid hatal o been employed Miscellaneous Sources of Plant Poisoning -In addition to the diseases described nume out other instances of noisoning by alants are known some acc dental in priets and some intentional Steam (sour) has recorded a number of the mnortant plants that have an ed poison og in South Africa. Chestnut (1808) li ted only about 10 pecies of plants associated with accidental poisoning in man poisoning with them gen rally resulting is no c niusing poisonous plants and harmless ones as mistaking water hemi ck for ellie roots. However, Mucascher (939) lists 400 speci s of on son us if at an the United States which has caused bo soning other in man or an mal. The f mile a that contain the largest number of poison u peere are the i is c ar Ranu cularea Legum nosue Eugherbiacea Embellif ra Sola aceae and this ta Peu ic adoceurs in many valuable loads and for tremos d may stoduce sensus solts and even death. Ozabe and blessee is not ed in variable cuantity it many chille plants as sout grass and huba b and may cause poisons gif ngested in ull cient quantity. The finance i pil at I me a tat i mum also contains a) in genet glue de whi h occurs very arts in the id eliment of the plant and period in the seed

Mandioca Poisoning -The roots of the at a M will to po (swe t cassa a) and than he wil sma (b tter cassass) constitute e if the mo t important articles of d t I the natives in many parts of Misca : South America and in the West Indies

Consumpt on of unrise personmons especially by children in Australia has at t mes g en rice to mo s or I so se a us ympt me due to coagulat n of the fruit when ir comes into contact with the HCl of the gaste c suice and the gumming of pieces together into a fairly firm mass of pulp They may measure several inches in d'ameter and often ean only be effectually removed by average n

of somiting

gations carried out showed that chickens indepulated with unadulterated Jamaica ginger remained healthy while others indepulated with the ginger containing 1 5 per cent of the phosphate developed polyneurius after about 9 days

Carillo and Ter Braak (1932) described an outbreak of poisoning arising from apol and Jamaca ginger. Apid is an alcoholic extract of the first of the common partiety (Carium petroscliums or A pinus solitum). The drug has been used as an abortifacient and for mensitual disturbances and in malaria and contains from ±8 to 50 per cent of troothocres) phosphoric acid. Carillo found that secondary changes might occur in

the simile cord which had not previously been noted.

Water Hemlock —Poisoning from species of the genus Cicula (auter hemlock) of the Parsley family is not uncommon in man and cattle. The poisonous property "ciculoun" is a resinous substance found especially in the roots and root stock. The leaves and fruits may apparently be eaten by animals without danger. Children and adults have cate the fleshy roots, mistking them for parsinps, artichokes or other roots and serious or fatal results have followed. The symptoms are pain in the stomach nausea sometimes leading to violent vomiting durthees, disted pupils, labored breathing sometimes frothing at the mouth, weak and rapid pulse, and violent convulsions. In fatal cases the convulsions grow more violent until terminated by death, which results from respirator, failure. In cattle, spasmode contractions of the displacem occur instead.

The poison hemlock of the Parley family (Common maculation) is probably the most operably home poisonous plant historically it was said to have been administed by the Greeks to Socrates and other State presoners. Cases of poisoning has occurred recently from accudental extinct of the seeds which have been multaken for those of same or exting feaves mutaking them for parsley, or the roots for parsings. The plant seems to be most posseous in the spring. The 3 approximates must present and gradual reakness of muscular power. The power of sight is often lost but the most gradual states of muscular power. The power of sight is often lost but the most usually regained sclear until death ensues from the gradual paralysis of the lungs is difference from poisoning by water hemlock is the absence of convulsions. Obviously, and all cases of poisoning of this nature an overthe, should be administered immediate.

Mustard Oil Poisoning (Epidemic Dropsy) — Epidemic dropsi is a discovery of the continuous of the cutters. Late Banerji and Ghosh in Bengal, and Lal, Roy and Ghosal in Calcutta also supported this idea.

juscitivits and inflammatory changes in the other murous membranes result if the part is touched with the fingers on which the later is present. If the fruit weaten swelling of the lips and bitsers and crosses of the bursal murous may occur. Nausea vomiting and difficulty in awallowing may be present sometimes heard stools with blood and more rarely manifestations of profound collapse occur.

Earle (1935) says the wood shows a handsome grain and polishes well but local expenters will not often use it because its sawdust causes cough rhimitis laryngitis conjunctivities and lachymation.



Fig 262—H pp m me ki lls Fr t d i fio esc (Ph tog ph i k l E 1 Co rtesy Tr m R y Soc Trop M d & H)g)

Treatment's largely symptomatic. It is recommended that the manchined juices present in the skin should be sumed atoly wished if with salt water. If the fruit has be eat in an emittic should be given.

The latter of the plant has sometimen been mpl yed by the natives as a hument and the dend for it is have been used as a durent. The seeds or tan a purgat on oil. Plants Especially Used for Crummal Pulsoning—The root of Gors as sepreds a plant widely of the bed of tropped whas a different has been used to produce poisoning it is somet mes called wild acoust and the plant solegical effects due to the active per copie supervision are number to those of acoust po sounger-integrand numbers.

The roots are generally dued and ground into a powder and used as a flour that forms the base of casawa cakes. In more civilized areas starch and tapics are prepared from the roots. Butter casawa contains a glicousde which in the presence water sets free HCN and in order to aword possoning the tuber must be expedigated aquested free of its infly junce and then thoroughly washed. Then it is often dired in the sun. In cases of possoning nausea womiting distention of the abdome and impeded respiration occur.

Holland (1938) points out an interesting though not uncommon instance of a fruit being both edible and a dangerous poison. This is the ripe fruit of the cultivated tree Pangium edule Reinn, which is quite whole some while the unitipe fruit produces illness or even death. The kernel may be eaten after steeping and baking.

The fruit of the nild tree at all stages and the kernel are possonous and the service kernel of the wild fruit, which is sweet like energed eccount can be added to food when its presence cannot be detected. Lethal doses have thus been placed in food and it has been widely used for homeadal pumposes. The chief use of the nint in som villages has been in straing fools. The scraped kernels are thrown to fools and there quickly after eating them. However the crop is then tenuved and the find farly be eaten. Chemical examinations have shown that the kernels contain hardowymin concentration probably in combination as in the case of the placends animation.

Various species of Jatropha (physic nuts) are found in Inda and the West Indies and symptoms of severe gastro intestinal irritation, more or less like that of croton oil result from eating the seeds Similar case of posoning have been reported by Raymond from Tanganyika as due to the ingestion of the nuts of the coral plant

The nuts of the species Jairopha multisfda taste much like sweet almonds. The leaves of Jairopha seems in the West Indies have tetrating hairs which may cuts swelling of the hips nauses and prostration. Another species found in the Dnited States from Virginia to Texas J stimulosis (spurge nettle) produces similar symptoms Fainting occurs in severe cases.

The manchineel tree (Hippomane manufalls of the order Euphor biscars) has long been a source of poisoning in the West Indies, northern South and Central America, and Florida It is a handsome tree averagem 30-50 ft in height and a circumference which may reach 5-10 ft. Two starteties are recognized, one with holly the leaves and the other with laurel like leaves. The former is more common. Both are equally poisonous and produce fruit resembling crab apples which have some times been eaten with fatal results, especially by those unable to obtain other food. However the taste is pungent and to some disagreeable. The latex contains a greenshir resin which is the active tone principle. There is a legend that it is dangerous to sleep under the shade of the tree as death may result and it is also said that smoke from the burning a nod produces severe inflammation about the eyes. Rain drops falling on the skin of a person shelring beneath it may cause irritation. All parts of the tree appears to be toxe.

People who are hypersensitive who pick the fruit may suffer from a skin irritation consisting of at first an erythema and later the formation of vesicles and bullac. Con

becomes volent but hate on dress meets sets in followed by coma. The yellow oleander, Ce 8 a thretia is a very possoone plant found in India. The poisonous principles are glucosides nenoside and oleandrousde and are found in the milky later. Similar substances ureclatin and urechitorin from Level 1 substances ureclatin and urechitorin from Level 1 substances are complained and in many core before suspension of possoning is amoust?

The juste of a species of Asrl fram (of the Milkweed family) has been used in India as an infanticide. It produces symptoms of vomiting salvation and cramps and final collarse. The roots of various species of Acoustins already referred to have been used.

for the same purpose death often taking place in from 3 to 4 hours

In New Gause. Hollind (1933) reports that the cating of the roots of wild species of Derrais the commonest form of acuted among the natives. The root is known under the native of bun, and it has only been identified as Derrai root since the plant has become of while as an inspecticed. The conditions he found at utilizing are indicating of acute congestive heart failure. The poisonous substance of the species Der 1 places is reduced. Other tour censan are also present as derried. As an activate the natives use the say expressed from the roots of the banana. which is muriliginous and sets as an emotic

Common native possions comployed in Braml sac prepared from Poull sac passable which contains an alkaloid (tumbus) and from the front of Parerise abase, which contains the possion theretoin. Both of these cause vomiting and acute respiratory failure. In the Dutch East Indies the common possion is extracted from the roots of secrees of Mildrid = Follo sing its insection debilisation beadeshe durkness and desired so that the desired of the process of Mildrid = Follo sing its insection debilisation beadeshe durkness.

collapse usually occur followed by death

Jengkol Pousoning —DeLangen has reported especially the occurrence in the Dutch East Indies of posoning from eating the pod fruits or beans of Pitheeslobium germinum one of the species of the Mimosaccae. The fruit is eatlen with great avidity by the natives although it has a foul odor. It is crushed and rossted before us. The beans are sometimes put through a preliminary appetizing process. which serves to increase their forcities.

They are first bursed in the ground for about a days. When they begin to aprout they are ready f ruse and are eaten | Jengt i so prepared as ealled beweln in Java. The seeds contain aetherial oils and exert a powerful trittat ng action. It a small amount is taken there is apparently no other effect than causing the urine to assume a most unpleasant odor though red blood corr uscks may be found in the sediment However if larger amounts are consumed in ld cramps in the I ins may follow as well as spains in the bladder. The urine then c ntains some albumin and many red blood cells and leucocytes. The odie of the urme and of the breath makes the diagnosis quite easy. If large amounts are tak in the porsoning is so ere and the nicture alarmine Intense c i cky pains in the abdomen and I ins occur with sometimes your ting and con tipation coupled with flatulence. Int ents are sometimes sent to the hospital with a d agnosis of peritonities. In some instances, the symptom, resemble strongly those I know stone. The urine is highly col red and concentrated resembling in at juice e nia) he much albumin and many evals as well as a large quantity I blood. The urin has the characteristic penetrating disgusting od r f 3 ngkol. In som cases anuria de el pa and then the diagno is can be made fr in the od r of the b ath. The most striking c test tuent of the strike is the sed m at f m il sharp alghtly soluble cry stale which d sappear a short time after the unne has been passed and kept in the isboratory. It langen bel wer that these crystals go e use t the kniney symptoms in a purely mechanical way han been and Higman have succeeded to extract ng this same systall ne substance from the jengk I beans which they named djenkolauur (s ge he acid) A a further product I dec mposits n ch n ta tic acid was f rmed. Delang n

points out that apparently the glucosul is related t that of mustard of fo med by

of the lips and pharynv nausea vomiting abdominal pains cardiac depression and collapse symptoms. Consciousness is retained until the late stages when convul ions may appear.

Various plants belonging to the order Solanaceae are used in many parts of the tropical world and by criminals in temperate climates to produce unconscioustess. Chopra has reported fatal cases of possoning from Jatropha in India in which the symptoms were dryness of the mouth and throat dilatation of the pupils and delinum.



Fig 270 — Hipp mane manchin !! Inflorescence (C u tesy Roy Soc Trop M d & Hyg)

The seed of Das is futures are used by the Thuyan Indias to produce unconscious and various other plants whose alkaloids have a similar action to belidional used by the natives of many parts of the tropical world. The seeds of Datara have only a slight taste and are consequently easily introduced unit food D is sequence has been employed in Peru and Colombia and D force and D orbore in Brail. The character title seeds are sometimes foul an the faces on in fatal cases in the intesting

The dned leaves of Hyoscyamus urger at henhane is the basis of some of the knock out drops used by the underward. In possoning from these plants there is a flushed face widely dilated pupils with the eyes bright and shung. The throat I very day There is marked disturbance of vi oo. At first the victim is very talkative and soon

more of the following sites were always involved nape of the neck, and upper back waist line (anterior posterior or on one side) sides of the ankles iloral surfaces and sides of feet and lower one third of the legs in every case the sites of the lessons corresponded exactly with one or more of the dhobie marks on their recently laundered clothers worn by the individual. Recurrence of lessons was noted promptly if marked clothes were again worn.

As their article implies this form of dermatitis should not be confused with Times crises infection which is described on page 1168 of this book Dhobie itch has been a well recognized form of trichophy ion infection

Dhobie rich has been a well recognized form of trichophy ton infection among white soldiers and evaluans in the Philippine Islands since the early days of American occupation in 1899. It is not the custom of Philippine washerment to mark (clathing in this manner. The trichophy ton fungus may almost invariably be found in scrapings of the skin from the lesions. (See p. 1190.) This form of dhobie it the san entirely different affection from that referred to by I wingood Rogers and Pitz Hugh.

Waud and Fem (1943) have also referred to this form of dermatitis in our troops in India caused by the ink from the bichi nut used in marking clothing. They produced the lessons experimentally by placing, some of the juice of the nut upon the skin. In 12-24 hours a reddened area appeared around the patch. In the severe reactors the patch became swollen the micular area changed ripidly to a pipular and then vessular type of lesson. The tiching was interval and the heads of the vessels were soon removed by scratching. The treatment is primarily by removal of the cause.

Coklamith (1943) has reported dermatitis affecting 16 persons (employees of one of the large government departments in Washington) due to handling mail contaminated with the juice of the bhilawanol or the Indian marking nut A bottle in a sealed mail pouch shipped from Inilia by air had become partially opened and its contents (thick black oil) had contaminated various pieces of mail. The contaminating substance was labeled bhilawanol oil Three workers who were unpacking the pouch wiped the oil off the mail as well as they could It was then distributed by a force of carriers and clerks numbering approximately 50 By evening a number of workers complained of itching and burning of their hands arms and face Within 24 hours a vesicular eruption appeared on the expo ed parts. Some of the workers did not touch the mail until as I mg as 5 days after it was unpacked but these also developed an erupti in 14 18 hours after contact. Exentually 16 of approximately to exposed persons developed dermatitis of varying degrees of severity The appearance was similar to that of typical dermatitis venenata from hhus t sucedendron. The oil | obtained from the junc of the marketing nut the Semecarpus anacardium. It is a member of the same family inacardiaciae as the severe irritant I hus plants of Mangilera the cashes nut and the agent crusing dermatitis in Japanese lacouer and the Mangs (See page 1209)

enzymic action. It is this substance that gives the urine its penetrating odor. The anuna usually passes off in a day or two but the urine continues for a long time to show a trace of albumin Dellangen bas not seen fatal cases Mreyen (104t) reports two fatal cases in both the kidneys were very hyperaemic

The jengkol bean has a bigh vatamin B content and is used as a food in spite of its toxic properties. In some instances an increase in the excretion of sulphur is found in the urine

Opium.-The use of opium is common among the inhabitants of India and the Orient not to refer to the drug addicts of Europe and America. In India Perus and Africa opium is almost invariably eaten or taken in pill form and with its use in this way the ill effects are much reduced. The mental moral and physical deterioration so common in those who smoke opium as in China Malaya and sometimes in Persia of who use morphine or other alkaloids hypodermically is not so marked. There is also less tendency to increase the dose Every medical man should read DeQuincey's

Confessions of an English Oppum Later to appreciate the slight effect this habit had on the author for the first few years of his addiction. He took the drug as did the pative In the Far East native mothers and wet nurses sometimes smear the nipples of the breast with the drug and it has been a not uncommon custom for the native nurses or ayahs to soothe babies to sleep by dipping the finger in opium and giving it to the baby to suck Such treatment is obviously bighly deletenous to the child The minutely contracted pupils may suggest to the practitioner this form of intoxication in obscure cases of allness

Erythroxolog Coros -- Cocaine has been especially used in India and in parts of South America as a stimulant or intoxicant. In India the drug is chewed with betti aut and slaked hme (chusass) In the uplands of Peru and Bohvia the leaves which are first dried in the sun are also chewed with hime. The natives have the custom of making a ball of the leaves which they carry most of the day between the mucous mem branes of the gums and cheek. The drug produces at first a loss of sensation in the tongue and lips followed by dryness of the mouth and fauces the pulse becomes acted erated and a period of bilarity or exaltation due to over-stimulation of the nervous system occurs From the chronic use of the drug honever the taste is soon abolished through the anaesthesia of the nerve terminals Permitious symptoms soon develop The individual becomes emaciated and eachecise. There is often insomnia and diges tive disturbances. The appetite is loss and the individual soon becomes under nourished and vitamin deficiency disease to bkely to ensue. A large percentage of the native inhabitants have become addicted to this babit in the mountainous regions especially of Peru and Bohyia

Dhobie Mark Dermatitis - Livingood Rogers and Fitz Hugh (1943) have described 52 cuses of dhobic mark dermatitis resulting among American soldiers serving in India due to articles of clothing worn by them that had been marked with the pince of the marking nut. They were informed that the marking fluid used by the dhobies throughout India is obtained from the nut of the ral or bela guits tree The exact localization of the circumscribed patches of dermatitis on that part of the skin in contact with the dhobie mark and the course of the lesions made it quite obvious that this represented a contact dermatitis induced by the marking fluid which the native dhobies or washermen used in making their charac teristic laundry marks A large series of patch tests was made not only to prove the causation but also to establish constant factors so that the true incidence of sensitivity could be determined. Of previously affected persons 80% were positive to patch tests. The first symptoms were localized pruritis at the site of contact with the mark during 8-24 hours This was followed by localized lesions varying in severity from moderate erythema and ordema to definite vesiculitis oozing and crusting One or

Mukher; S P Lai R B an l Mathur R B L Investigations into the Epidemiology of Enidemi Dronsy Part XII Isolation of Active Substances from Toxic Oils Indian Jl Med Ret 29 361 1041 Raymond W D Ta ganyika arrow poisons Fast African Mrd 31 15 410 1030 Reuter R J & White S J Susceptibility to and latency of poison tvy dermatitis

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Wand S 1 & Fein H Dermatitis Ve enata Caused by the Ink from the Bichi Nut US I my Ved D pt B il 59, 1943
Weber I T I xternal caus s of dermatitis list of unitants A h D mai & Syphi

35 120 1937

lang R T Some Clinical Observations and Opin one on the Subject of Atripl cism Jah Ji Dermal & L of 48 103 1010

Merrill (1944) (an emment authority) points out that it is evident that as the nar progresses there will be other cases of dermatitis observed in the active and potentially active areas caused by species of the last cardiacae which have such a world wide distribution and he lists a numbe of the more important species which are liable to give rise to di turb a, dermatitis in tropical countries. He adds that on the whole he suspects that it will be only on rare occasions that cases of anarcardiaceous dermati tis will be noticed and if such cases do show up then one should apply the same treatment that one would use for Rhus dermatitis at home

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worm may cause symptoms very varied in character and the same might be said of the ubiquitous round worm

CLASSIFICATION OF THE NEWATHELMINTHES (ROUND WORMS)

Class Nematoda				
Superfamily	Family	Genus	Species	
Rhabd asordea	Strongy loudidae	Strongyloides	S stercoralis	
Trichuroidea	(Trichundae	Trichuris	T trichiura	
	Trichinellidae	Trichinella	T apiralis	
	,	Ancylostoma	A duodenale	
	/Ancylostomidae	Ancylostoma	A braziliense	
	1	Necator	N americanus	
	1	(Ternidens	T deminutus	
Strongyloidea	Strongyhdae	Ocsophagostomum	O ap ostomum	
			O thomas:	
		Syngamus	S laryngens	
	Trichostro gybdae	Trichostrongylus	T colubriformis	
		Haemonchus	il contortus	
	Metastrongy hdae	Metastrongylus	Al abu	
Dioctophymoidea	Dioctophymidae	Dioctophy me	D renale	
Oxyuroides	Oxyundae	Enterobius	E vermicularis	
		Ascans	A lumbricoides	
Ascar dea	Ascandae	Toxascaris	T leonin	
		Toxocara	T canis	
Spiruroidea	Spirundse	Physaloptera	P caucanca	
opnatoraca		Gongylonema	C pulchrum	
	Gnathostomati fae	Cnathostoma	C pinigerum	
	0.000	Thelazia	T callipaeda	
	,	Los	L loa	
	(·	Wucherena	W bancrofts	
Filanoidea	Filamidae	lilana	F malayı	
	{	Mansonella Acapthocheslonema	M ozzardı	
	}	Onchocerca	A perstans O volvalus	
	Descunculatae	Dracunculus	D medinensis	
	(G gastorh) nchidae		M hirudinaceus	
Acanthocephala	O gantomy nemone	hynchus	vi nirudinaceus	
(Class)	Von Mormidae	Mon liformis	M mon bforms	
(~1435)	,	Ultrada	II medicinalis	
Annelida (Phylum)	II rudinidae	Limpatis	L nilot ca	
Heru i nea (Class)	Haemad p d e	Haema hoss	H eylanica	

The subphylom Nemathefmonthes is disided into two classes it Nematoda which possess a girth tax are without a prodocus and the Acenthorephalia absent this protocus present. The former includes the subclasses Euro matoda and Gord acea of which the latter are accident by sparsition must The Funematoda continuous mustle free lange forms ford it's gustased some untor it which are occusion contains a mustle free lange forms ford it's gustased some untor it's he'd are occusion. The funematod is a substantial to the substantial and the substantial

Note —The Annelida are grouped with the round worm table for c meni nee only do not to show taxonomic relationship. The Acanthocrphila are not closely related to the semantoders and their to onomic position is still in doubt.

SECTION VII

ANIMAL PARASITES, INCLUDING HELMINTHS, INJURIOUS ARTHROPODS, POISONOUS FISH, SNAKES, AND COELENTERATES

Chapter XLIII

COMMON COSMOPOLITAN HELMINTHIC INFECTIONS

GENERAL CONSIDERATIONS

Surveys in various parts of the tropical world often show more that oo per cent of the children and almost as high a proportion of adults to be infected with heliminths. Of the cosmopolitan round worms. Assent and Truchuris are the roost common and of the tape worms, Unsmoother some. These 3 heliminths do not require an intermediate host in their life history so that the unhygeme ways of living of the most primitive peoples give opportunity, for almost univer all infection.

The morphology of any one of these parasites and the appearance of the ova as well as the treatment of the infection, are the same whether it is encountered in topical or in temperate climate. Movestral ind them are found more frequently and in far heavier infections in the former

than in Europe or America

With such round worms as Trichinella sproils or with tapenorms Taema signata T solium and Diphyllobollarum laium secondary hosts are involved in the life cycle. Liven if introduced into new territory such infections fail to spread if the custom of eating raw or insufficiently cooked pork beef or certain hinds of fish does not exist among the native The trematode parasites of man all require two or more hosts in their life history.

In many parts of the tropics it as usual for the patients in the native chine to harbor the round worm Ascars: the whip worm, Trehmis the hook worm Angloston or Accader or at times all three. However it is of course advisable to have accurate laboratory data as to the presence of the out of intestinal parasites more particularly as to Ascart, we that in getting a history we may not be led astray by complaints of intestinal distributionses. Sitels has astressed the fact that the bed lapse

worm may cause symptoms very varied in character and the same might he said of the ubiquitous round worm

CLASSIFICATION OF THE NEWATHELMININES (ROUND WORMS) Class Nematoda

CIRSS MEMBROOM				
Superfamily	Family	Genus	Species	
Rhabdiasoi lea	Strongy loldsdae	Strongyloides	S stercorahs	
Trichuroides	Trichundae	Trichuris	T trichiura	
Micharores	Trichinellidae	Trichinella	T spiralis	
Strongy los des	Ancylastomidie	Incvlostoma	(A duo lenale	
			A braziliense	
		Necutor	 americanus 	
	Strongyl dae	Ternidens	T deminutus	
		Oesopha gostomum	O apiostomum	
			O thoması	
		Syngamus	S laryngens	
	Trichostrongy lidae	Trichostrongylus	T colubriforms	
		Haemonchus	II contortus	
	Metastrongylidae	Metastrongylus	M apri	
Dioctophy moidea	Dioctophymidae	Dioctophy me	D rensle	
Oxyuroidea	Oxyundae	Enterobius	E ermieularis	
		Ascans	A lumbricoides	
Ascaroidea	Ascandae	Toxascaris	Т і опіпа	
		Tox cara	T canis	
Spiruroides	Spirundae	Physaloptera	P caucas a	
opiraroides		Gongylonema	C pulchrum	
	Gnathostomatidae	4 Gnathostoma	G p nigerum	
		Thelazia	T callipseda	
		,Loa	L loa	
Filamoidea	Filamdae	Wuche ena	W bancrofts	
		Filana	F malayı	
		(Mansonella	M ozzard	
	1	Acanthochestonema	\ perst ns	
	1	Onchocerca	O 1 rulus	
	Dracunculdae	Dracunculus	D medinensis	
	Gigantorhynchid e	Macraeonth r	M hirudin eus	
Acenthocephala	{ ` `	hynchus		
(Class)	Monshformdae	Monthforms	M moniform	
	II rod n dae	Hrudo	H med maks	
Annelida (Phylum)	tr ton n dre	Limuatis	I tulotica	
Hirudinea (Class)	Haemadipsid e	Haemadip a	II zeylanıca	

The subphylum Nemath liminthes is divided into two classe. the Nematoda which possess a gut but are without a proboscis and the Aca thorephala n wh h the gut i absent but proboscis pr sent. The former a cludes the subclases I unemated a and Gordiscea of which the latter are acc d ntally paras tic in man. The Funem toda c otains normally free living forms (order Vagantia of some authors) which are occasion ally introduced accidentally into man and the more import at parasitic forms (order Parasita of some authors) Fight superfam hes of the parasitic forms are included in the Key Ir m Yorke an I Mapl at me but se eral of the gro pa here classed as fam 1 a are regarded as superfamilies by some a thornties.

Note -The Annelida are grouped with the round worm tabl I r convenience only and not to show taxonomic relationship. The hearthocephala are not closely related to the nemstodes and their taxonomic position is still in doubt.

CLASSIFICATION OF THE NEMATODA (ROUND WORMS)

The nematodes are cylindrical non segmented parasites usually taper ing at both ends They are white, red or yellow or brownish in color and sometimes semi transparent

All menatodes are covered with a cuttede varying in thickness and frequently mixed. Characteristically the cutted is mounted from times during development. The cutted is formed by the underlying ectoderies which is as a rife markedly thickness desired the time of the cutted of the cutted in the cutted in the cutted was at to form four ridges which divide the body into quadrants. Within the ectoderies is the body cavity a space containing clear fluid in which the reproductive organise the exercise system susually consists of the others which discharge near the bright of the exercise system susually consists of the others which discharge near the bright.

While the alimentary cand is more or less tube like in appearance it above nor the mouth a distinct or sophagus. This may have a senity musculature and his apposed to a single row of large accretory cells (Trichwordea) it may be muscular without globular bulb (Strongyloidea) or muscular with a posterior bulb (Oyumudel) if Illianoidea and Spuruordea the osposhagus may be dynded tandem. There is a price

ring around the oesonhagus

The testis and ocary are generally tube like. The sexes are as a rule separate. The make can usually be recognized by its smaller size its curved or curicle pointered at times exhibiting an umbrella like expansion—the capulatory bursa. The spicales chitimous copulatory strictures may be observed drawn up in the worn or projected out of the cloats. The genital opening of the female is vestria and may vary in position from close to the mouth to near the tail. That of the mile is close it he amus and both open into a common cloate a hisch opens in the ventral line is the cloaest aperture. Certain papullae in the region of the aous are valuable in differentia topo of species.

Many nematodes develop in damp earth from the eggs as rhabditiform lanac Very few nematodes are viviparous (Il uchereria Trichinella) most of them being o

paroua (Ascerss)

The parasitic Lunematoda are divided into at least eight superfamilies

KEY TO SUPERPARILIES (Modified from Yorke and Maplestone)

r Heterogenetic parasitic form parthenogeoetic Rhabdiasoides

Not heterogenetic parasitic forms sexually differentiated

2. Oesophagus consisting of a marrow tube with reduced musculature in association with a row of single oesophageal cells the suchocyte

Tricharoides

Oesophagus not of this type

3.

Oesophagus not of this type

Males with a bursa copulatrix

Males without a bursa copulatrix

Bursa copulatrix cuticular and supported by rays
Bursa copulatrix muscular and not supported by rays

Strongyloides Dioctopbymoides

5 Oesopbagus dilated posteriorly into a bulb usually containing a denticular apparatus and frequently separated from the rest of the oesophagus by a constitution to the complete of the oesophagus of the oesophagus of the oesophagus by a constitution of the oesophagus of the oeso

Oxymonic

Oexopbagus not dilated posteriorly into a bulb
6 Read with three large lob 5 or laps relatively stout worms
Ascaroida
Head without three large lobes or hap but with two lateral lips or 4 or 6 small lips
or lops absent relatively stender failing worms
7

Untilly with the lateral laps chansons because you exhibite usually present with usually in the middle of the body or posteror to it parasites of almentary cachal respiratory system or orbital nasal or oral cavities. Sourceded the subject of the property of the prope

The family Anguillabine (normally free hung nematod's occurring only accidentally in man) contains the pener. Rabidus and Anguillabic Several spaces of Rabidus have here reported from man. Anguillab acris the vinegar cel. has here reported from the gentiounnary tract several tunes. Such cases can be explained by the pror containmation of the unne hottle or by the use on the part of the patient of a vinegar variand double.

SUPERFAMILY I-ASCAROUDEA

The parasites of this family have a mouth commonly provided with 3 prominent lips supplied with papillae r dorsal and 2 ventral but lacking a buccal capsule Fig 271 The ocsophagus is muscular and usually with out posterior hulb Males without

out posterior hulb Majes without a bursa copulatrix and usually without caudal alae

Genus Ascaris Linnaeus 1758 — This genus includes those species of ascards in which the lips have dentigerous ridges but in which ee vical also are absent They re relatively stout worms

The male I smaller than the female and has a comeal tail without caudal alae. In front of and behind the cloacs, there are numerous papillae. The spicules are equal in size and have no lateral

WIDES



Pro 271 -Ant r t m ty fA tymb cord : A seen from fr nt B se fr m d 1 u f (Tys naft r Rallt t)

In the female the vulva is double and situated in front of the middle of the hody. The eggs are characteristic in that they are known as in color and have a thick smooth shell surrounded by a corrugated or mammillated albuminous coat and in that they contain a large unsemmented orum when passed in facees.

Type species Asca s lumbricaides Linnaeus 1758

Ascarasis caused by infection with Ascars lumbricorder which is probably the most common helimitatic infection of man especially of children A species morphologically identical has been encountered in pigs and in the gorilla. If occurs throughout the world in temperate as well as tropical regions and has been reported from the arctic regions. The most severe injections are encountered usually in tropical countries where in the warm most chimate personal hygiene and environmental conditions combine to favore embryonation of the own in politicel soil

Morphology—The par site is large (from ay-no-cu in length) and in shape and sine somewhat rescabiles the common carth worm being yellowsha hate and a light brown in color. The female genital system is double. The worms as cylindrical thereing to a little point a first off the three parts of the property of the strength of the point of the size would be -3 min in diameter. The males are slightly more siented and shorter and from ay-9 cun, long. The month is provided with 3 p titles entired a size of the si

CLASSIFICATION OF THE NEMATODA (ROUND WORMS)

The nematodes are cylindrical non segmented parasites usually taper ing at both ends They are white red or sellow or brownish in color and sometimes semi transparent

All nematodes are covered with a cuticle varying in thickness and frequently matel Characteristically the cuticle is moulted four times during development. The cuticle is formed by the underlying ectoderm which is as a rule markedly thickened internally so as to form four ridges which divide the body into quadrants Within the ectoderm is the body cavity a space containing clear fluid in which the reproductive organs he The excretory system usually consists of two tubes which discharge near the head

While the alimentary canal is more or less tube like in appearance it shows near the mouth a distinct desophagus. This may have a scanty musculature and he apposed to a single row of large secretory cells (Tochuroidea) it may be muscular without a globular bulb (Strongyloidea) or muscular with a posterior bulb (Oxyuroidea) In Filartoidea and Spiruroidea the oesophagus may be divided tandem. There is a nerve

ring around the oesophagus

The testis and overy are generally tube like. The sexes are as a rule separate The male can usually be recognized by its smaller size its curved or curled postenor end at times exhibiting an umbrella like expansion-the copulatory bursa. The apicules chitinous copulatory structures may be observed drawn up in the worm or projected out of the cloaca The gental opening of the female is ventral and may vary in position from close to the mouth to near the tail. That of the male is close to the anus and both open into a common closes which opens in the ventral line as the cloacal aperture Certain papillae in the region of the anus are valuable in differentia tion of species

Many nematodes develop in damp earth from the eggs as rhabditiform larvee Very few nematodes are viviparous (Il schereria Trich nella) most of them being ovi parous (Attorit)

The parasitic Dunematoda are divided into at least eight superfamilies

KEY TO SUPERPANILIES (Modified from Yorke and Maplestone)

Rhabdiasoidea r Heterogenetic parasitic form parthenogenetic

Not beterogenetic parasitic forms sexually differentiated 2 Oesophagus consisting of a narrow tube with reduced musculature in association Trichumidra

with a row of single oesophageal cells, the stichocyte Oesophagus not of this type

3 Males with a burra copulatria Males without a bursa conslatus

4 Bursa copulator cuticular and supported by rays

Strongyloidea Dioctophymodea Bursa copulatrix muscular and not supported by rays 5 Oesophagus dilated posteriorly into a bulb usually containing a denticular appara tus and frequently separated from the rest of the oesophagus by a constriction Oxyuroidea

Oesophagus not dilated posteriorly into a bulb Ascaroidea 6 Head with three large lobes or lips relatively stout worms Head without three large lobes or hos but with two lateral lips or 4 or 6 small lips or lips absent relatively slender fillform worms

7 Usually with two lateral lips chitmous buccal cavity or vestibule usually present volva usually to the middle of the body or posterior to it parasites of alimentary canal respiratory system or orbital masal or oral cavities Usually without hips buccal cavity or vestibule absent or rudimentary vulva almost invariably in the ocsophageal region parasites of the circulatory or lymphatic Filamoidex system or muscular or connective tissue or of scrous cavities

transmitted primarily by direct hand to mouth transfer of eggs which have developed on the moust floors of the house The larvae (o 24 mm long) are liberated in the contents of the small intestine

Stewart (1916) Ransom and Poster (1917) and Ransom and Cram (1921) and independently the investigations of Fulleborn (190-26) demonstrated that these farvae penetrate the wall of the small intestine reach the mesenteric lymphatics or mesenteric venules and are carried through the night heart to the lungs. Here after a sojourn of several days they usually break through the pulmonary capillaries into the air sacs and are carried up the broncholes bronch and trachea to the epigotiss are then swallowed and pass down to the small intestine, where they develop into adult makes and females.

In individuals exposed to heavy inoculations with infective stage eggs some of the larvae may pass through the polinomary expollances into the left heart and systems crucil to man dray he filtered out in avoration and insists of the stage of the larvae may be filtered out in avoration and times of the filter has been as the stage of the stag

On reaching the intestine the larvae (20 to 30 mm long) develop into adult forms after a period of 8 to 10 weeks. The life span of the adults has been estimated at about a year.

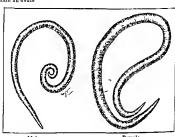
This cycle has been demonstrated by feeding mature A lumbiscoder goa to rats.

gunes pigs a d boy. In these animal, the own hatch and the harves migrate to the beer larges and fact to the instruction (4though in such unstable bosts development usually does not go on to the production of mature adults). The same appears to be true in man. Knone e.g. swillowed good mature Area so was and developed pro sourced symptoms of large parolevement with bloody sputume containing larves. Fifty days later following an antichemistic 667 worms were recovered: O bonda swillowed larves taken from the lang of a genuca p.g. and ten weeks later ow appeared in b. slaces have a taken from the lang of a genuca p.g. and ten weeks later ow appeared in b. slaces have a taken from the langest miner to be supported by the second on the second part of the success of the second part of th

The round wo m of the pg: A smalls is morphologically relentical with A lumins code but it has been suggested that it is hologically distinct. Feed g expeniences if the kno obother a suggest of the mother parasite will develop! mutury as a rule cept in the hologically of the feed o

1222 ASCARIASIS

After fecundation the females discharge enormous numbers of ova estimated about 100 000 cach daily. They are objurted 40-50 by 60-75 m. They are provided with a thick smooth translucent inner shell and a rough mammilated outer out which is sometimes lost. The Contents are granular not segmented and usually shor a clear crescentic area at each pole (Fig. 274). Eggs which are deposited unfertuled are markedly abnormal in their appearance often longer trangular in shape and some times grotesquely misshapen with structureless granular contents so that they may be misstaken for vegetable cells. Their occurrence may midicate that the host barbor only female worms. Occasionally in human facces the albuminous coat of the fertulent egg disappears and it is then somewhat difficult to recognize. The presence of the large owum entirely filling the egg is however sufficiently characteristic to identify resembles an Ascons egg. It is however considerably smaller ro-nos. It does not contain an owum.



Male Female Female Fro 272 — Ascars lumbrico d s (Male and female) Natural si c (After Brumpt)

Life History—There is no intermediate host. The own in fresh faces are unsegmented and non infective. In the presence of warmfu (but not a body temperature a little moisture and oxygen segmentation occurs outside the body and development of the embry is completed after an interval of from 10 to 20 days or more (rarely less than 30) depending upon the temperature (optimum 30°C). Normally the larel remains within the shell until ingested. However latching can be induced we descenting and then munitening the ovar and the larvae may live for the owner of the descenting and then munitening the ovar and the larvae may live for the owner of the contraction of the owner owner of the owner ow

Infection —It is generally helieved that infection normally occurs by soil pollution is common or in which human faces are used as fertilizer Ox a may be conveyed to the mouth by dirty fingers (especially in children) or by contaminated water green vegetables or other food and possibly inhalation Scott (1939) has shown that in Egypt the infection is

brain spinal cord and in the kidneys. In their passage through the liver from the intestine and the lun's they are not believed to produce appreciable symptoms

Symptoms Produced by the Adult Worms—The adult worms fre quently live in the upper small intestine but as they wander about within the body they are found in other sites. As a rule the number present is small but tarely many hundreds may be present. If numerous they tend to aggregate in clumps which may be demonstrable in roentigenograms as filling defects and may cause intestinal tostruction. The worms may migrate up or down the meetinal tract being passed per ainum or vomited when they reach the pharynx. They may penetrate into any accessible passage or space and cause hizerra and sometimes serious focal.



*** ***

disturbances e g into the appendix bile ducts gall bladder pancreatic duct nose sinuses middle ear and larynx. In some instances they have perforated intestinal ulcers: Guiart and also Brown (1934) considers it probable that 12 rarys may suck blood and sometimes cause intestinal ulceration and bacterial infection. Fast (1940) states that at times they may pinch off small masses of the intestinal epithelium. Rajahram (1938) has reported the case of a girl of 6 who died with 5 12 caris containing abscesses in her liver.

One abscess had opened in the op pastic suppose it way a most from which a see dish and excepted while the was under observant at the hospital when the had emacation fever and an ealarged it v: 4s and pay there were still worms in the cavity into which the sas r am. The did test of a diamed bid excit showed other worms and there was one in the diseasement though santoning dring life had not led to the passing of wo ms. They hat eash been found in pulmonary that one.

Mill n (933) reports a child of r m nth wb ded of suffocation the result of se eral ascards in the traches. The e were also mo e found in the stomach and intestine 1224 ASCARIASIS

Ransom showed that a serious lung disease (thumps) of little pigs is caused by disease larvae passing through the lungs

Terecurs in . (Belescentre cut) and Tenscent cents (Tenscents cans) the common security of the cat and dog respectively have sometimes been reported for many recorded cases for the former and r of the latter. They are much smaller than A imphrenders averaging about 3 inches in length and are characterized by may like projections from the anterior cent by reason of which they are called the strong branch ascands. The eggs are thick shelled and somewhat similar to those of A lumbrander Tenscent length in the common the type species has been found in Carmyon and

Lagochilascaris Minor Leiper 1900.—This ascarid is a normal parasite of the small intestine of the cloudy leopard Felir nebuloso and has been recovered 5 times from abnormal foer in human cases from subcutaneous abscesses of the neck near the angle of the jaw from tonsillar abscesses and from the orbit in a natives of Tundda and

once from a mastoid abseess of a patient in Dutch Guiana

According to Faust the adult male worms measure 9 mm in length by 0.4 mm in diameter. The females 15 mm by 0.5 mm in diameter. The worms lack excisal abs but are provided with a transplar keel along the enter lateral line. The three has are invested with a thickened raised cutticle such with a compacious verticle close the the enter Isbail structure is separated from the cervic by an engirding furnor. There are about a pairs of premail pupilike arranged in a single longitudial row in the worm lateral position on each side of the median ventral line. A winned pair and a single pain of positional position and as side of the median ventral line. A winned pair and a single pain of positional position and a single pain of positional position. All hough the life cycle is unknown it is probably direct with those of Tomsom coli. Allhough the life cycle is unknown it is probably direct with own without a required lung migration. In the human rasts sported the worms taid obviously become lodged in abnormal flow where they had been able to mature and provide supportuley processes and aboresses.

Pathogenicity of Ascans—In mild infections the symptom may be trifling. Disturbances may in some instances be produced by the migrating larvae and others by the adult worm. The migration of the larvae through the walls of the intestine into the liver and lungs gives rise to unimerous muntue hemorrhages. The diameter of the larvae in passing from the pulmonary capillaries to the terminal air spaces is considerably greater than that of the capillaries then elves hence more or less training and petechial haemorrhage takes place. Small confluent baemorrhages may occur in the alveoid and smaller bronchioles, giving rust to some oedema. In some instances there is a local infiltration of polymorpho nuclear and tosinophilic leucocytes about the parasites and these with the desquamated epithelium and serous exudate may fill the air spaces and produce consolidation. The respiration may be serously embar tassed and in extreme cases complete consolidation of the lobes may occur.

Keller (1932) points out that this condition of ascars paramonity or search paramonal particularly important in children. Amon (1942) after seal owing paramonal particularly important in children. Amon (1942) after seal owing many eggs in the infected stage suffered with a marked rise in temperature and severe portions. In children there may be an elevation of temperature to 30 of 40° to 5 days after exposure to infection with frequent spanns of coughing branchair rates and signs of lobular involvement. Il tempolysis may occur with harven the blood tinged spottum. Usually these symptoms subside on the sixth or seventh day but it is regarded as probable that handle distinct and others who are exposed to very heavy infection may at times succumb to pneumona especially when complianted by a secondity betteral infection. If the layes erach the general circulation they may be filtered out and in certain fock both small or severe symptoms depend on the number and location. Distributions have been reported from their presents in the

Girges (1934) has found different extracts of Jacons to contain to ins include g a aphylamin neurotomic haemolysms and condocumentous. In children Asso is infection sometimes gives use to pallow of the face with bilter longs under the eyes and interferes with nutrition. Restlessness vague abdominal pa ns and nausea are not uncommon symptoms.

Sang (1938) has demonstrated that in wife watery extracts of Asceris contain a readily diffusible protease which can inhibit the action of pepsin and trypsin by combining with it. This substance is found in different issues of both the male and female worm but in variable amounts in different organs. The substance is of the order of a primary albimose It is only slowly destroyed in acid rapidly in alkali and is not digested by trypsin. To this substance he has given the name ascerase.

The crept intestal data thous that if the worms are at all abundant in the host is mistine the quantity of chabital produced would play a surfaces that in decreasing the amount of protein degrees and the amount of protein degrees are the surface are the

Laboratory diagnosts depends upon finding the ova in the faces or the adults after a vermiduge. It is usually easy since the typical os are unmistikable and numerous (about 2000 ova per gram for each female). Ova which have lost the outer shell or unfertilized ova may be difficult to identify. Even if there is only a single female worm present the daily brood of eggs is large enough so that some of them may be seen in the centifuscalized specimen of the facecs.

Nevertheless Hus and Chow (530) in a large series or some 8 o autopase through a number of years found that 4 a star = present in that 1 stars = 0 rg 3 per cent. However du ng life sto l'examination kind been m'd en 14 ag and in 44 no own had been fou d'o so that the stool examination distected only - q per cent of the infected perso 5. This only emphasizes the care with which the ex ten nations must sometimes be conducted. In 30 of the case there were only male worms. According to Yolo gava (33) male worms only may be present in the bowel in ab ut 3 per cent of the cares. In such instances the designes samy be suggested by the chapteral immifrestances.

In the early stages of the infection the diagnosis of pulmonary disturbances caused by the migrating larvae may be difficult. Keller and his associates (1932) believe that repeated migrations of the larvae to the lungs may give rise to an increase in the bronchovascular markings.

The skin test has been suggested for diagnosis Bachman points out that a positive test does not necessarily imply infection at the time it is obtained A commercially available iscars antigen is prepared by the Lederle Laboratories It is not regarded as of practical value for diagnosis

Provnosis

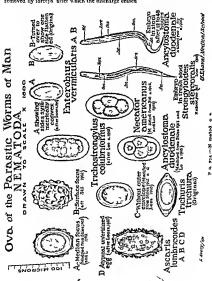
The prognosis as a rule is excellent. In cases of acute abdominal symptoms operation in time may save the patients life. Cases with pulmonarty symptoms may demand careful aurising to insure recovery.

Oedema of the glottis may occur and the writer has seen suffocation result from counting a mass of worms in a cholera patient

Figure 273 illustrates a number of worms obstructing the appendix Faust also illustrates a case in which the parasites blocked the appendix of a child aged 6 years, with an antimortem discusses of 'agute abdomen

Exploratory celestomy revealed 9 worms in the peritoneal cavity in addition to others which were blocking the appendiceal lumen. The child died of peritoniti

others which were blocking the appendiceal lumen. The child died of peritorial Chanco (1938) reports a case of a child 3 years of age in which there was a discharge from the umbilious from time to time since birth. An Assaris presented itself and was removed by forceps after which the discharge ceased.



with the treatment of an accompanying hookworm infection in the following way

(1) A preliminary done of sodiums sulphate should be given the nght before (2) in the more go an a mighty stomach the patient emanaing in bed a combined anthelement mature totaling a C (2 minums per year of age for children) consisting of tetrachiberchipee (2 r pc.) and old d'hemopodium (6) as C) is administered at one time in capsules or in a tesspoon with sugar. (3) Two boars later a follow up saline pation is carried out to remove the morehood worms and to prevent absorption of the drugs by the internal wall. (4) The patient remains in bed and takes no lood therapeating procedure has been regarded as both size and efficient and has no contrained cations. It may be repeated after 5 days. However the great undestrability of old of chempodoulum is that its contrained cations to the therapeating produce in the size of the description of the contrained cations.

Herylresorcinol has also been advocated Momma (1938) has reported go cases treated in Japan with this drug to to 5 per cent in the different groups Over 50 per cent showed some unfavorable symptoms from the action of the larger doses of the drug and in some cases in which larger doses were given the percentage cured was reported to be lower

Smillie (1939) while admitting that an ideal helminthic has not yet been discovered recommends herylresorcinol which he has found will remove go per cent of issers in a single administration without danger to the host. A single gram dose for adults is recommended early in the morning or on empty stomach followed in an hour by a saline purge with no food taken until noon. For children the dose is 0.6–0.8 gm.

Faust (1940) believes that a most efficient treatment with a maximum of safety and a minimum inconvenence both to the physician and to the patient is to be found in caprulol (heydresorciol crystoids). The drug is not only most efficient but is less tone. It is assued in 0 a gm hard gelatin capsules and is administered in the morning on an empty stomach without need of a preliminary purge (t gm for adults o 6 gm for children under school age 0 8 gm for those between 6 and 10 years of age). Two hours later a staline purge is administered to remove the dead and dying worms. Food is proscribed for 5 bours. The only additional necessary precaution it to require the capsules to be swallowed without being cracked open or chewed up to prevent chemical irritation of the buccal mucosa by the free drug. In the average group of individuals this therapettue removes up to 95 per cent of all Aszarie worms and produces up to 90 per cent curs. If an excessiry it may be safely repeated within a days

None of the anthelmmitics used in the evacuation of Ascaris from the intestinal tract is effective in killing the larvae during their migration period through the body

UNYURIASIS OR ENTEROBIASIS

Due to Ovyuris or Enterobius vermicularis of the superfamily Oxyuroidea

1228 ASCARIASIS

Presention

Human Axaris infection is primarily acquired by the introduction of the infective stage ovar into the digestive tract. The one are usually derived from human sources since there is no definite evidence to show that portine infection plays a part in the epidemiology and etiology of human exarrasis. The inlection is usually spread primarily without household and hence proper sanitary facilities in the house is one of the most effective means of control. While it is present in all age groups, it is especially an infection of small children from it to 5 years ol age.

Cort and his colleagues have shown that both in the tropics and the southern United States searchasts is essentially a deoryard and household infection primarily propagated by the seeding of the soil immediately around the house with egis which are present in the faces of small children sho is turn become reinfected from size which they pick up on their fingers and introduce into their mooths. The eg's deposited in such localities may remain infectine for many months. Accompressions rural districts where latines are in use is one of the most sensitive measures of the employment of saintainon. In the southern United States Cort (tot and Spinder showed that even if all the people except a few of the youngest children used private the infection might still be manufasted at a high level.

Whenever it is possible all infected patients should be given prompt treatment to eliminate the parasites. However, reinfection from the contaminated sites will probably occur in many instances. Hence successful results can only be expected through hygienic conditions and the substitution of flush totlets for priviles or latrines, and by public health training in schools or by public health turning in sch

In countries where human facces are used for fertilization all raw vegetables are apt to be infected. There is no definite evidence that infection may occur by the cutaneous route, but in some countries currents of mosts air may pick up the eggs in fine silt and in this may they may be inhaled and reach the phary are and he swallowed. It has been suggested that such infection has occurred in northern Asia and in Africa. In support of this, Boggiawlenski found Ascaris eggs in the nasal mucus of 32 per cent of school children examined.

Treatment.—For years the classical remedy for the treatment of

Ascaris has been santonin, given in doses of oil to o grams for adults and with children about oor gram for each year of age followed by a saline purge. However in the tolerated doses it is very frequently insufficient. If given in efficient doses in the extremely tour. It may cause visual troubles even in small doses and give a brownish yellow color to the unne. In excessive dosesge it may cause vomiting and convulsion.

Its use was largely replaced by oil of chenopodium. This drug is efficient but it is also very toxic. Smillie reports that in the treatment of over a million people in Brazil with this drug that there were 22 deaths. Four persons to whom he administered the drug died with convulsions. Faust believes that oil of chenopodium should never be employed in the treatment of ascansais alone but that it may be employed in conjunction.

often comes out of the annu when the child in warm in bed and the inspection of the princial region may thow the parasise. The male is about 1-5 min flong the female larger 6-13 mm long by 0-1-0 a mm wide. The male has an incurved tail with a single specie and the female is long tupering tad. The widrs is in the antieror titred. These worms have a clear bulbons projection shaped like the month piece of a Turkish page surrounding, the three hipsed antenne extremely. There is a well marked value

shaped ocsophagus The eggs have a thin double-contoured shell are planoconvex 20 by 50µ and show a coiled up embryo. After myestion of segmented eggs the adults develop in the small intestine where copulation takes place. The males disappear or die. The fertilized females usually go to the caecum and colon where they remain until the ova have developed. The cycle occupies about four weeks. The females then wander to the rectum and work their way out of the anus to deposit their eggs on the skin of the permeum. Ma ked itching is a common symptom. This is more pronounced at night and the scratching so induced causes the eggs to be widely spread about the region of the anus. The fingers thus become contaminated with ova which may be carned to the mouth and so can e a fresh infection. The underwear bedding towels wash basing floors etc are frequently contaminated. The possibility that the eggs may be au borne has been shown. No intermediate host is necessary. About 36 bours outside the body in abundant oxygen is required for completion of development of the infective ta ipole stage. If reinfection is avoided the infection may die out spontaneously in a few weeks

When the infective on a are swallowed they pass to the duodenum where they hatch and the larvae are set free. They then pass down the small intestine directly, (without migrating through the intestinal wall) and after moduling twice mature in the flewm or in the large bowed. The adult female worms not infrequently after passing from the anus unsade the varing and urethra and sometimes the preduce.

Pathology

Faust (1940) has noted that the young males and females attached to the intestinal wall may produce mild catarrhal involvement of the imme duate tissues where they reade and that in sensitive indyduals their byproducts when absorbed may cause a characteristic helminthic tox aemia. Econophilia may or may not be present. Manton Bahr (1940) reports that the mature worms may penetrate the mucoca and encyst in the submucosa of the small intestine or appendix where they may give rise to inflammation.

A number of writers have recently reported instance of appendicitis

Battagia has found the parasites in the appendix in per cent of the c ses of appendix in a children when the orga was removed to prestrion whill If it is and Frown (1939) found Batterboan in it appendix set out it consecutive cases of operation while the presence of the appendix Levin on the c reported the presence if Enterbo to under the aeros of the appendix Levin on the c reported the presence if Enterbo to under the aeros of the appendix Levin on the presence of the presence of the appendix has printed out these paras he may give more to an appendix performed in in the wall. While Up is 1935 post to out they may allow pashing no beateria to enter the mucess of the appendix. Boats of (1939) reports that 7 of 1333 apper direct enterous the concess of the appendix. Boats of (1939) reports that 7 of 1333 apper direct removed it. Children if 19stal Boston op 39 per residenced with p arounds. Thenthy and had succeed print of the manufacture of the appendix and the sufficient of the control of the sufficient of the control of the sufficient of

Worms with three hipped mouths Lips simple or indistinct. Oesophagus shows definite posterior bulb usually containing a denticular apparatus Example pinvorus of family Oxyundae Genus Enterobius Leach 1853

Enterobius termicularis (Oviuris vermicularis), the common pinnorm



Pig 275 - Enter bing ber miculares (a) Femal (b) (c) Co led posterior ex tremity of the mal show ng th spicule (d) Egg (After Leuckart from Brumpt)

or seat worm has been known since ancient times. It is cosmopolitan in distribution but is commoner in warm countries probably because in these there is usually less attention by the people to personal hygiene

> However recent investigations carried on by the National Institute of Health, under the direction of Crara show that it is very common in some temperate climates

Thus a survey of various groups in Washington D C showed an incidence of 35 per cent in over 600 persons examined by anal swabs. All positive cases found but only part of the negative cases were followed by examination of the families of which the individuals were members since pinworm infestation is usually a familial affair and commonly about three fourths of the members of a family were found infested. The high incidence in Washington suggests that when pursonne are given accenter attention in the United States it may be found that the situation here is in fine with that stated by a number of well informed parasitologists is that pinnorms are the most common and widely distrib ted of human belminth parasites. The parasite is found more frequently in children than in adults

Cram (1937) and Smith and their associates (1939) in their survey in the Southern United States found's somewhat heavier infestation rate among the males as compared with the females Enteroblasis is more com mon in asylums and in infected groups or families rather than in populations at large Cram found that ar examination of 628 individuals in the general population group showed 35 4 per cent inlested while Smith in an institution for mentally deficient found the unu ually high infestation rate of 65 15 per cent

The eggs containing the embry os which are discharged by the female worm usually after moving about outside the anus or infected patients contaminate their clothing and fingers especially beneath the finger nails These eggs are the immediate source of infection and of most reinfections

Morphology and Habitat.-The adult worms live in the caecum appendix and adjacent parts of the colon and deum with their heads attached to the mucosa The females sometimes invade the female genital organs and bladder and have also been reported in the ear and nose The worms are small and about the thickness of a pie e of coarse thread The white squarming worm frequently may be seen on the surface of the faccal mass or moving about the permeal region of the child The female worm

The shape of the egg is atypical in being so perfectly aval and without one side **Hattened**

in the faeces usually in not over 5 per cent of the cases (Faust, 1940 Africa 1040)

Diagnosis of the infection has been greatly simplified by Hall (1937) and his associates who have recommended and used a cellophane anal

swab Smith Gill and McAlpine (1939) Sawitz Odom and Lincicome (1939) and Ruhe (1940) have all emphasized that the cellophane swab is much more successful in giving a positive diagnosis than the direct examination of the stools or of concentrated faeral films. They point out that it is also of much greater value than the previous swabs recommende 1

Smith has shown that the salt flotation method of examination of the stools is neither accurate nor dependable for finding Enterobius eggs. He found 99 5 per cent of the cases were positive by the swab method whereas only a oper cent were positive by salt flotation

Of 400 positive examinations by anal swabs 73 6 per cent were found on the first examination and the remaining 26 4 per cent after 2 or more e aminations. Other observers however recommend that at least y consecutive swabs should be taken before a suspected case is diagnosed as negative

Reardon (1918) has pointed out what to the uninitiated might cause confusion namely that artifacts which simulate ova of enterobiu may be present in the cellophane of the NIII swab described by Hall for use in the diagnosis of pinworm infection. The structures are markedly similar to the pinworm egg. The hyalin outline appears to be composed of several layers and resembles the transparent shell of the egg of Enter obius The central mass is irregular brownish or greenish the size usualls fails within the range of the nin worm eggs

Treatment

A knowledge of the life history-the early location in the small intestine and later on in the large-shows that treatment should be dual in its direction enemata to remove the gravid female in the rectum and anthel mintics to destroy the young adults in the small intestine Some still question whether an entirely dependable therapy for pinworm infestation has yet been developed

High enemas frequently remove the majority of the free females in the colon. For this purpose infusion of quassia diluted 1-40 has been I equently employed the olution being injected slowly and the foot of the bed raised so as to allow it to percolate through the bowel. It is advisable before admin stering the quassia to evacuate the rectum first by hot water enemas. However, such treatment frequently does not sucreed or remove the new groups of parasites which are developed higher up in the bi wel

For the destruction of these parasites many anthelmintics have been recommended by one author or another but most of them have proved valueless More recently Wright (1018) has recommended tetrachlor ethylene The recommended dosage is 3 cc for an adult 3 minims per year of age for children Purgation of the patient should be obtained the night before preferably by the use of sodium sulphate 30 gms in a half glass of water. In the morning the patient should abstain from food before the drug is taken. Two hours after administration of the drug a saline purgative hould again be administered. Poisoning has cometimes resulted from the u e of this drug Sandground (1941) mentions 2 cases of coma when doses of 4 to 5 c c were given

1232 OXYURIASIS

releved by appendectomy. Schwarz and Strub (1940) have also emphasized time portance of oxyunds in appendicts with purplest unflammation. Abbum (1941) his found that thread worms are encountered in normal appendices as well as in the which show chronic inflammatory changes and more often than in these that we acutely inflamed. In the study of a large series by sections he came to the conclusion that these parasites are not ethologically related to appendicute.

Africa (1938) has emphasized disturbances occasionally caused by the gravid females migrating up the vagina and uterus into the fallowar tubes where they have become either encysted in this organ, cassing symptoms of salpingitis or continue their wandering into the penioneal

cavity where they have become encysted in the peritoneum

Jones and limiting (1931) have reported the case of personans a years old with satery of probinged persons the beatman its right and with inspirence of pura and tentres in the lower part of the abdomen accompanied by fever and leutocytes. Laport only revealed acture appredictus and acute alapoptiss with Errichous is both practical Africa points out that the presence of these worms in the abdominal early has been availably reported in the fineles subject and since numerous reports of the presence of this parasite in the vagina uterus and fallopian subes have been made it sent clear that the route usually tachen by Interobuse in the impaction to the abdominal early is was the genital tubes from the answ. Wu (1932) has shown that they may produce symptoms of a slapaping in which may continue for years.

Blacklock (1938) has pointed out that the eggs can sometimes be obtained from the washing of infected garments and Lentze maintains that the ova can be inhaled through the nose at some distance from

infected garments

Symptomatology —In addition to the symptoms resulting from the pathological changes already described pin worms commonly give rise to prurities an which provokes scratching of the urnisted parts sometimes resulting in heemorthage eczems and progenic infection of the snal and per anal regions or of the entire perious. The abraions of the mucosa of the caccum by the parasites may expose nerve endings and give rise to nervousness, insomms and even epileptiform seluries, especially in children. Masses of the parasites in the rectum may give rise to symptoms of rectal colle. Sometimes the adult femilies may pass up the bower wall into the upper portions of test may be sometimes the adult femilies may pass up the bower wall into the upper portions of the small intestine and may eventually reach the stomach, ocsophagus and nostribs

Diagnosis

Ova are rarely found in the facees, but may be found in scrapings from self askin about the anns or from under the nails. The diagnosis is preferably made by examining the stools for the white thread like lemales which are expelled after a diagnostic dose of calomel and saifs or after an enema. These females which are packed with embryo-containing eggs, may be seen wriggling on the surface of the freshly possed facees In handling these worms care must be taken to avoid infections with eggs which may get on the fingers.

The diagnosis may be made by finding the ova in the faces or in scrapings or swabs made from the persanal region or beneath the finger nails. It may also be made from the finding of the adult worms especially following enemas, or of discovering the female parasites wandering our of the abus which particularly occurs at might. The eggs have been found

factory in infants and young children if given every other night for not less than 3 or 4 weeks but the course had often to be much longer.

Manson Bahr (1941) has stressed the use of phenothism e for the treatment of thread worms. Children from 5 to 10 years old receiving 5 grains daily for at least

10 consecutive days 2 d for children under 5 years the dose is halved

Errington has noted toxic symptoms in the treatment of horses with this drug such as anaemia albumunu in and haemoglobinum and later work seems to show that

its use in man is dangerous

Joh stone (94) points out that in 58 published c ses of treatment with pheno thiszane for thre d worms 8 showed some form of toxic rection. He bence considers that this use of the drug cannot be pushfied

Bercovitz et al [1942] teated so patients children and adult for entered u if ct ms with phen-thiakatone. Two patients were considered cut of the 0th rs we not. Mot 1 [943] believes that phoenoth azone should be given only t patient who cannot be cureful open as a worker own h a cantiformat it it leshould obe given to patients who cannot be to be viol once e.g.y days. He adwe the dose of phopo tha e should not reveal op on my per kgm. Hould wight IF himself safely and

successfully used the dose for a of h patients

is n of air currente ie theoretically poe ible

Prevention—Pes a hippene is definitely indicated for the pevent in of renfect on Steping dra end strong outst and orting be east inglish chould be a The fig. in I should be carefully pared and the band was held after defect on Tope event their gast in ghit the axis may be an instead in the incursion intermet or unique to event their start of the strong of the strong of the strong of the strong booling. To I seems should be regularly clubbed and ste based. I find its or homes whe come member a infected

Ne extheless the work of D Auton and Sawatz demonstrated that it was impossible to entirely exter number to meferican or even to prevent infection in other individual; by r g d bygenic measu es carrie 3 out in an institution. Only by treatment with gentian works in addition to the employment of bygenic measures could the infect in gentian probes in addition to the employment of bygenic measures could the infect in of the infected and viduals alone will not suffect to in an institution of o urase sense if a single infected and should remay be constituted as error growthem and engress to

g probable course of reinfection

Nolan and Readon (939) found the eggs of Ent ob us in duet collected at all

Nolan and Readon (939) found the eggs of Ent ob us in duet collected at all

They believe infec

TRICHURIASIS OR TRICHOCEPHALIASIS

Trichuriasis or Trichocephaliasis is caused by the whip-worm Trichuris trichiura of the superfamily Trichurgidea

It is characterized by a long thin neck and a the exerte minal potion. The oesopha g s consists of a narrow tube with reduced musculature. It has a thin wall and is apposed to a single row of large excretory cells. The annu is terminal. There is only one ovary.

The families TRICAURIDAE and TRICEMENLEDAE are distinguished by the latte being much smaller not having a spicule and c pulatory sheath and being viviparous Genus Trichiurs (Roederer 1761)—Trichiurs trichiura (Trichi

cephalus Schrank 1718) Trichocephalus dispar Rudolphi 1802 the whip worm is one of the most common parasites in both temperate and tropical climates. It gets its name from the resemblance to the whip the posterior end resembling the handle and the anterior extremity the lash. The species was first correctly named by Linnaeus in 1717. The life cycle was demonstrated by Grassi (1887) and later by Fullechort (1920).

Geographical Distribution—The parasite is cosmopolitan in its distribution but is more common in tropical regions where the warmth and humidity contribute both to the incidence and the intensity of the infection

1 Cort (938) points out that while wh paorin infection is more or less co-extensive with that of Arcoris lumb scodes the former is more prevalent in access with high rainful and humility and dense shid.

Faust (1940) states that this treatment while at times quite satisfactory is not consistently so. He believes that a relatively satisfactory method of treatment consists of the administration of caprolo (Herni resortion) crystod(s), I gm for adults, o.6-o.8 gm for children on an empts stomach in the morning

The patient is required to availow the capsules unthout cheang and to fix this sequently for a hours. The same might the large howel is thoroughly a valed out with a sam water enema after which as to 400 cc of ST 37 a solution of hydrocran (o 1 per cent) is institled as a retention enema and retained for 75 to 30 mutes. The crystoods given by mouth kill the norms in the small insectine while the olution institled into the colon cleans out the female worms on the lower bond. Two or three courses of treatment usually completely endicate the infection provided endetions in not acquired in the mean intime. Cutaneous lessons around the arms produced by scratching and frequently aggravated by bacterial invasion should be treated by pallatine or a natseptic outness like borated vaschine of yellow mercuric order.

Still more recently. Wright and his associates (1940) and D Antoni and Savitz (1940) have recommended the oral administration of gentian violet medicinal for treatment in ½ grain enteric coated tablets manufactured by the Seal Ins Laboratory and by Ely Lilly & Co. Tay employed tablets of the four hour type which are said to dissolve in the caecal region when administered. Treatment of infected boys and girls with this drug resulted in the cure of approximately 90 per cent of the caes. The drug was administered to infected and individuals from 3 dorintones.

In the first dormitory the sdult dose recommended by Wright ass employed namely 1 grain of the drug was given 3 times doily before meals for a period of 8 days followed by a 7 day medication free period after which the 8 day course of treatment was repeated. In the second dormitory 1 grain of the drug was given 3 times day before meals for a period of 3 days followed by a medication free period of 3 day. The procedure was repeated 1 until 0 days of treatment (i.e. 4 fixeds) counts of teatment) that daps of making the entire period 3 days. In the third dormitory 1/4 grain of the drug was given 3 times daily before meals continuously for a period of 35 days.

After such treatment swabs showed that 94 per cent of the positive cases in dormitory I go per cent in dormitory II and 89 per cent in dormi

tory III were free of pinworms

The drug was found in general to be well tolerated However of those who took I grain of gentian violet 3 times a day more than half (\$4 out of 95) complained of loss of appetite abdominal cramps or nauses at one time or another whereas of those who took ½ grain 15 out of 45 complained of these symptoms V Owning occurred in a high percentage of those treated with uncoated gentian violet tablets

In a more recent report. Wight and Brudy (1979) point again to the efficacy of this drug tested on stap prisons. It man given in daily doese of 1970 pring for adult before make a relative to a report of the state of the state of the state of popularity of the state of the state of popularity of the state of the state of popularity of the state of the sta

intestinal wall but interlaced in the microsa where according to Hoepph (1930) they may secrete lytic substances. Chitwood (1937) and others believe they may possibly such blood. It is believe di that they may some times cause attacks of urticaria. According to Faust in heavy uncomplicated whipworm infection the patient may show marked emacation with a dry skin and mucous diarrhoea rarely with blood and a reduction of the haemoglobin which may reach as or top per cent. Pallister (1933) has reported masses of worms extending as far down as the ascending colon Clinically such cases may suggest severe hook worm disease and it is said patients so parastized may soon succumb unless the vorms are removed Swatzwelder (1939) has studied 81 cases uncomplicated by other infections.

In most of the cases the infection was heavy More than two thirds of the patients fell within the age group from 6 to 15 years. White patients predominated over the colored in 2 ratio of 5 to 1 and females over make in a ratio of 2 to 2.

The most frequent symptoms were abdominal or epigastric pain vomit ing constipation freer distention or flatilitience headache backache loss of weight and anoreus. Abdominal or epigastric pain was the most frequent compliant noted in 50 cases. The duration of the symptoms in 44 cases was 3 months or less. In a number of the cases the abdominal pain was localized in the right lower quadrant with nausez constipation and fever suggesting appendicties. No marked diminution of the red blood count was noted and this is in accord with Otto is studies in Louisian in 1934. Swartzwelder found the cosinophiles averaged 4 z per cent with 24 per cent the maximum.

However the number of cosmophiles varies greatly. Ofto belie es it is probable that estimophile is produced by chronic whysoern infections though there may be an esimpohile response to accuse ones. Foreign Nuncz horever found that colino estimates and the second production of the colino and produced that colino construct of the cases in the second product of the cases in the color of the cases and however, the color of the cases and however, the color of the cases and the case of the case o

Diagnosis

The diagnosis can be made by finding the ova in the stools Concentration by centrifugation or brine flotation as described under Ascaris may be accessary to reveal their presence in mild cases

Treatment

Treatment is not always satisfactory. The drug which has been said to be most efficacious in the endocation of the parasites Except de Ingueron or higher latex obtained from certain species of trees of the genus Freus in Central and South Amenica. The active punciple is an enzyme which has been extracted from the fresh latex or sap by Robbins (1930) and was named from He concluded that the active fraction was a proteolytic enzyme of the tryptic type. Favorable reports of its use have been made by Sprut (1972) Hall and Augustine (1972) and Calidwill and Calidwill and Calidwill are the support of the

Morphology and Dielogy

The worms are 30 to 30 mm long, the fernoles slightly longer than the mais. The caphaic half to two thuris of the body is thread like and contains only three-spains. This has a reduced musualizer and as appeared to a row thange secretory cits that stacked the substances with the lames of the economical agreement. The thick caused a substance with the lames of the economical approximation. The think caused the substances of the economic thread and pertures. The thick caudal portion of the body (the handle of the whip contains the intensity of the substances of the contains the substances are seen as the substances are the substances where the substances were contained to the substances where the substances were contained to the substances are the contained of the thread to the contained the substances as the contained of the thread to the substances as the contained of the substances are the contained of the substances as the contained of the substances are the contained of the substances are the contained of the substances are the substances

The worms are found chiefly in the caccum also in the appendix and terminal fleur.

They attach themselves to the intestinal wall by transfixing a fold of mucosa with the

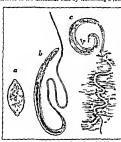


Fig 276 — Ty thi 1871 isth ura (a) Egg (b) Female (c) Mal with neck embedd d in mucous membrane sp spicule (After Leuckart)

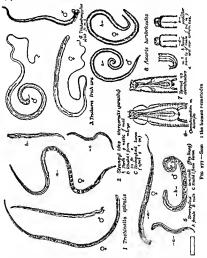
alender prek and have been thought by some to facilitate the entraces of typhod bacilit and other pathogene bacters and the trause. The characterist ion are deposited in the faces. They are oval structures x_{10} by y_{10} brown in cider in the magniture of granular contents and a their translationatest capsule which has a knowled protrusion at each end somewhat like a bottle stopper. Segmentation occ. 3 outside the body and is a protracted process requiring from 6 weeks by the is said? If me is The oval are resultant (except to descentancy) and have been reported to have retained their affectively for 5 years. There is no interendently below the processing of the contraction of the c

Infection occurs by swallowing infective ova obtained directly of indirectly from the soil. Areas in which there is a high incidence of infection are usually polluted by small children who are more commonly infected than are adults infected than are adults.

I athology

The infection is usually symptomic s Craig and Faust (1940) point out that worms may not only be attached by their anterior ends to the

or insufficiently cooked pork. Many cases of infection do not develop any striking clinical symptoms and evidence of the parasite is only found by post mortem examination.



Geographical Distribution — The distribution of T essi sis a consopolitan it has be nejectally evaluate in Germany and in early regars lurkow estimated the hum a nedence a that country as about ap per ce t. Alsh with its still stated to be a dely did at based to decreasing and the lower Danube country is sect statistics at the present time are not obtainable. In the List's lates t. common: Hall and Collins 1937 have reported the incidence of inchinosi from 11 suddy set tred cinesis in the United States haved on actually finding the praintest activity 3 at 12 per cet at 17 pl sundected classes once ut of e ery

(1929) However in not all instances has complete eradication of the worms resulted

Robbins and I mano (1934) have tested the enzyme action of 15 species of the genus Fixer from Colab and F. carres from Alabama but found that the protective activity of all except two of the species tested was essentially mil. However they found that say of 6 Fixes trees of South America had, high protective activity. Robbins of the protective forms of the say of 6 Fixes trees of South America had, high protective activity. Robbins of the preparation was found by Thomen (1939) to be highly efficient as as anthelimutic against Trackeephalus sulfus indication in dogs. Unfortunately the last stell Fixes after some forms of the protection of the street stell forms and borth and south America. All from the first hatter to great or the presence and borth and sold under the trade name Higueronia. However, Faust (1947) thinks the first crude taxes in better.

Other drugs which have been recommended for treatment are carbon tetrachloride tetrachlorethylene oil of chenopodium, and hexpiresorcinol These drugs, however may produce tour symptoms. Carbon tetrachloride is contraindicated in patients with hepatic renal or respiratory incolvements those with lever and in those having a blood serum calcium deficiency. Faust also cautions that carbon tetrachloride should not be administered alone when Actoris is present though it may be combined with oil of chenopodium, see p. 1270. Oil of chenopodium is more tour than carbon tetrachloride.

Recently Mackie (1939) and Smillie (1939) have pointed out the value of hexylresoreinol as an anthelmintic

For hexylresorcinol treatment preliminary purgation is desirable to free the caecum and appendix of faecal material

Heyhresorund crystodá (Captokol) are best given on an empty stomate had followed within a hours by a since purgature for small children under 6 years 4 de 6 gm is indicated and for children of school age the sdulf desage of 1 gm havy be administered. It is advised that the drug should be swallnest din a ster without being or chewing the crystods to a soid irritation of the mucosa of the mouth and threst ing or chewing the crystods to a soid irritation of the mucosa of the mouth and threst mucosa. It is advisable that the large bonet should be cleaned out with tiped sufficients on the significant of the significant common of the drug. Fault recommend also that 8 to 1 or or 8 7 3 m (hey)resortional re-to-ol) undistitled be introduced to the significant for the significant conditions of the significant cond

Prevention —Thorough cleaning of the hands before meals may do much to reduce both the incidence and intensity of the infection. Cases should be treated as soon as possible after diagnosis. There should be disinfection and saintary disposal of faces as is recommended for book worm infection.

TRICHINOSIS

Definition —A parasitic disease caused by Trichinella spiralis some times characterized by fever, gastro intestinal symptoms myalgia and cosmophilia the infection occurring in individuals who have ingested raw

female during copulation. There is no spicule and the cloaca is evaginated to act as a copulatory organ

The fem le is 3 to 4 mm long and 60 p broad and has a rounded posterior extremity with a prominent sht like closes. The posterior half of the body contains the overy and becomes swollen as the er s develop The valva 1 in the anterior fifth of the body After copulation the males may die and the saviparons females hurrow into the intestinal mucosa and for about 6 weeks continue to emit h ing larvae each producing a number estimated at from coo to ro coo in all The larvae are about room by 64 in Si e They penetrate into lymphatics or years and are distributed through the general circulation They soon penetrate into striated muscle being especially numerous in the diaphragm intercostals and muscl s of the neck laryon tongue and eye. Here they become encysted former forming o al structures about o 45 by o 25 mm in size surrounded by a tough capsule produced by the tissues of the host while the larva which has attained a length of a mm is coiled up in the center. Here they remain viable for a long time (some even for so to 20 years) although the larva eventually dies and the cyst becomes calcified When the cysts are swall wed the larvae are liberated in the intestine and within a few days develop into mature adults. This pa asite therefore differs from practically all other nematodes in that the larvae encyst in the same individual host which harbors the adult worms

Transmission—Man usually becomes infected from eating raw or improperly cooked port. Under natural conditions the infection chiefly affects rats and hogs. Hogs become infected especially by eating garbage containing ports scraps and to a less extent infected rats and rats by eating scraps of port and by cambalism among themselves. The infection is normally propagated by the black and the brown rat both of which are cannihalistic.

In an examination made in St Louis Mo 75 per cent of the rate wers found to be unfected. Many other animals however are also succeptible as well boars bear cats and dogs. Other animals as mice rabbits and guines p gs are easly infected when fed raw ment containing the parasites: While in America hoggs are most on monely infected in some localities in Europe dogs and casts have shown a highest per cause of the state of the same of the state of the same and the modeline in hoggs had self stated to be consistent of the first had no long and the same of th

Symptomatology and Pathology—The symptoms of the disease vary greatly and the picture of chinech inchinosas is frequently most confusing. This however is not surprising when one considers the wide spread distribution of the parasites that may occur in different parts of the body for the larvae have been found in almost every tassie fluid and exerction even though those which do not enter skeletal muscles usually die rapidly Rainson (1912) emphasized that an important characteristic of trichinosis whether mild or severe was the lack of regularity of its course. Symptoms depend partially upon the number of worms present and partily upon the insuess inwaded as well as upon the stage of the infection. In regard to the latter to begin with the infected farvae enter the digestive tract and develop into adults in the lumen of the intestine where they he partly within the villi. Later they give not to young larvae circulating through the lymphatics to the systemic and pulmonary circulation and entering such tissues as the lymph nodes and glands the brain the muscles.

Rappaport (1942) finds the males may outlive the females

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Winght (1938) summarizes the results in the United States as roughly 17 18 per cent of infection

The reports of clinical cases for the United States up to 1937 number between 5000-6000

In regard to tropical and sub tropical countries sporadic infections have been reported in South America, especially, from Brazil and Chile In Asia it is not uncommon in China and India but is not reported from the Philippines Cases have been reported occasionally from Australia (Manson Bahr 1940), but according to Bearup (1937) it is probably not endemic in Australia. It does not occur or is rare in Puetro Rico or in Mohammedan countries. In Africa, it has been reported in Algeria, Kenya, Uganda, Tanganyika, and British Nigeria.

Sandground (1941) says the disease is at present restricted to Europe and North America but occurs in immigrants elsewhere or in those who

have eaten imported infected pork products

History—Trichinella spiralis the cause of trichinous, was first discovered in the encysted stage in the muscles of patients at post mortem examinations in London by Peacock (1882) Human cases were soon reported also from Europe and North America Joseph Leidy, having found for the first time the cysts in hogs flesh in 746 suggested their similarity to those found in man Leuckart (1855) and Virchow (1850) demonstrated that these cysts when fed experimentally to animals the parasites were liberated and grew into adults in a few days and that the females in the duodenal wall produced harvae which migrated to the muscles and there became encysted Later it was shown that the consumption of infected pork insufficiently cooled or raw, was the source of trichinous in man

Thomas R Brown in 1897 while a medical student at Johns Hopkins demonstrated that the presence of an cosmophilia is highly suggestive of a diagnosis of trichinosis

Trichinella spiralis (Owen 1853) (Trichina spessib) the cause of trichinosis is a minute worm visible with an ordinary hand lens which in its adult stage inhabit the duodenum and jejunum. The made is about 1 5 mm long and 404 wide. There is a prominent testicular chilargement failing the wider caudal end of the body and two forces the caudal appendages which project laterally and chable the male to hold the

tory disease pleurisy asthma upper respiratory infection pneuroonia laryngitis conjunctivitis nephritis multiple neuritis intercostal neuritis and oneurotic ordema syphilis tuberculosis undulant fever tetamis nearlet fever measles mumps influenta frontal simu tits eryspicas and le d poisoning

Larvae in Heart, Symptoms -- Myocarditis systolic murmur at apex cardisc instability and dicrotic pulse diagnosed as myocard its rheumatic myocarditis endo

carditis or other heart d sease

Larvae in Brain and Meninges Symptoms — Encephal its meningitis cephalalga hemipleya delirium and coma diagnosed as encephalatis meningiti tuberculous meningitis and poliomyetilos.

Even in severe clinical trichinosis the first stage of gastro intestinal disturbances has frequently been absent. Posicionally also may be absent especially if there is a concomitant bricterial infection or may decrease if bacterial infection supervene. Again if peritorities is present the econophilis may never nea above; per cent. While there is usually a gradual rise followed by a gradual decline: the level may never be high and the occuranitals may persist for long periods after recovery. The myaliga may be generalized or definitely localized. In some in tances the clinician may be unsited and diagnose it as intercostal neurities or neurities deswhere or refer it to rheumatic conditions. Coular disturb ances as well as cardiac and nervous changes suggestive of meningiti rows all be confusion factors.

Briggs Bruck and McNaught (1939) have called attention to splinter haemorrhages seen beneath the finger and toe anals in 60 to 70 per cent of their cases of active trichinosis. McNaught regards it as a petechial manifestation similar to rose spots on the abdomen described by others

In evere epidemics the mortality may reach to preent Chandler (1940) remarks that it has been estimated that for man the ingestion of 5 trichina larvae per gram of body weight for man is fatal for hogs so and for sets so

Diagnosis —The great majority of human infections are not diagnosed during life the correct diagno is being frequently made by microscopical examination of sections of the diaphram of other muscles or of material obtained by artificial digestion of them after death

Hall and Collins have possited out that in not one of 222 infections found postmortem had a diagnosis of trichinosis been made during life although in some there were almo t 1000 parantes per gram of muscle and obviou ly any person harboring that many trichinae could not have been entirely free of symptoms. The difficulties in clinical diagnosis have been embhasized.

Too much weight must not be attached to any one symptom. A history of exting raw or undercooked pork gastro-intestinal disturbances ocidema petechnae fever myo its and cosmophilia are suggestive symptoms. However accurate diagnosis can be made only from the laboratory examinations.

Laboratory Examinations —During the first few days after infection while the ingested larvae are developing there is often a gastro-enteritis Purging then may be beneficial by indding the intesting of the infected

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of the heart and all other muscles and to some extent other tissues and various cavities of the body Finally we must consider the effects of the larvae degenerating and disintegrating in various sites and becomin, encysted and ultimately calcifying in such locations

With reference to the number of trackmen present giving rise to clinical symptoms, we have no accurate data. If all (1937) state that he feels auer that necessory of infestation of approximately soos lavace per gram diaphram muscle represent oraces of clinical trackmens and the suspects that those such only 1 tarva per toget of diaphram muscle probably do not represent cases of clinical inclinioss (sub-symptoms)

Gastro intestinal disturbances are often noted in the first stage of the infection Manson Bahr points out that such symptoms may resemble those occurring in cholera, or even in dysentery, with the passage of blood stained stools associated with hyperpyrexia. In severe cases during the migration of the larvae through the tissues there may be a remittent temperature with slow muttering delirium muscular pains pain on mastication, and disturbances of deglutition and respiration. The condition may suggest typhoid fever. Several neeks after injection when the embryos have encysted in the muscles a cachectic condition may result due perhaps to the absorption of toxins from the parasite when, in addition oedema of the face abdomen and legs may occur. In other instances there may be mental apathy and intense pruritis. Death may take place in the sixth or seventh week from exhaustion or from pulmonary com plications In cases which survive, the fever gradually declines but pains in the muscles may persist for long periods While such symptoms may be regarded as the classical picture of the disease even in severe trichinosis many or all these symptoms may be omitted

Hall (1937) gives the following list of symptoms and the diagnoses which have been associated with the effects of the parasite in several

locations rather than in just the location given

Larrae and Adults in Intestinal Lumen and Villi. Symphonis—Gattro-entribution for successive constipation and durrhoes vegetable supstools often with Charcot Leyden crystals nau or vorbring abdomost pain of varying degree and in vanous locations cold sweats but flushes intestinal lacenor hages and fever degreed as typhond fever paratyphond fever typhus lever choice choices morbus intestinal influence malarae ptomaine possoning lood pronoung agreementation of unknown origin agatio intestinal exatar hampondicuits coluin peptic

ulcer gall bladder involvement and acute alcoholism

Larvae in Blood Stream and Mwedes Symptome - Dounophilis objectual cologorythems in hypotensoon learned the cologorythems plant of baddy (expectally substituted when the cologorythem and another the cologorythem and the cathing learney cough the origh atthem themophysis pneumono of phages aphonas larguights myesitis myalga futurent loss custances exploses utriaces see spots dequaranton westing acady las itude sonnolence or insomna anoreus conjunctivitis corneal ecolymotes medians photophoris diplopra pale often slow by comparison its heaf, of feve albummuria present or ab eat indicatours present or about por interesting and cologorythem and the cologor

the stem of the funnel for larvae by means of the microscope (34 inch objective)

Also some meat may be fed to several white rats or mice. After 2 or 3 days examine the duodenal contents of one animal for adult worms After two weeks examine the muscle of the diaphragm etc for encysted larvae as above

During the second and third week in severe cases when there is high fever marked intoxication and prostration as in typhoid fever may occur There is often transient oedema especially about the face and eyes. There is usually a high leukocytosis with a marked counaphilia although this may be absent in the early stages and in fulmmant cases The I rose are then present an the circulat ng blood To demonstrate them withdraw about c cc of blood and lake in a volumes of a per cent acetic acid Centrifugalize and examine films of the sediment stained by Giemsa's method

From the tenth day on the larvae begin to migrate into the muscle and become encysted This is associated with severe pain at finess and disability. There is often painful labored breathing laryngetis with cough and occasionally haemoptysis. After this time excise a bit of muscle fr in the deltoid or pectoral muscle near its insertion and

ex mi e for encysted larvae as described above

Cutaneous Reactions -Bachman (1028) reported positive precipitin and intracuts neous reactions in infected animals using an antigen which he obtained by d gesting beavily injected muscle in pepsin and HCl and by washing drying granding and extracting the larvae so liberated C ca a solution may be u ed for extraction A com

mercially available Trickinello antigen is prepared by Els Lilly and Co
The introdermal test has been applied successfully to the diagnosis of buman
i fection by Augustine and Theiler and Spink and McCoy et al. (933) who obtained (in Rochester N Y) pos tive reactions (the immediate production of a large wheal) in 92 per cent of 36 acute cases and in 6 per cent to 80 per cent of cases from 3 months to 7 years after infection They gave o 1 cc of a 1 to 10 000 and if this is negative a r to soo dilution. Late reactions occur but McCoy found them unreliable in human infection. In most cases the reaction became positive during the third week. In a control set es 18 per cent gave positive reactions which is practically the incidence of infection found by Queen (1931) in a special study of 344 routine autops to (also in Rochester N Y) Kalgus (1936) in Puerto Rico found a positive skin reaction in 74 per cent of 66

cases of trichinous which might seem unusual in that locality McNaught (939) in San Francisco tested 63 individual and found 27 per cent who gave the immediate type of reaction and o per cent a delayed type of reaction. There was no history of infection in McAaught's cas s Schapiro Croshy and Sickler (1038) performed routine intracutaneous skin tests by Bachman's method on 400 individuals. Of these 116 died in which the reaction in 27 had been positive and in 80 the reaction negative Only 3 of the cases found to be pos twe to the skin test were found to be negative for triching infection at the autopsy. Autopsy record in San Francisco have shown that 4 per cent of the d phragms may contain living trichina

Failmezger and Spalding (1939) found Trichinella larvae in the venous blood of 3 of 6 children The intradermal tests were negative in all Precipitation tests were positive in 2 but negative in 1 Dammin (1941) reports one case in which larvae of Trichinella spiralis was found in the arterial blood after unsuccessful examination of the venous and capillary blood In this case the initial skin reaction to the National Institute of Health Trichma antigen 1 10 000 was of the delayed positive type This was followed by 2 negative reactions

It is unfortung to that the skin tests do not give positive reactions in trich nosis as ly in the disc se as is desirable. According to McCoy and his associates, they may 1244 TRICHINOSIS

pork and of some of the parasites The adults can occasionally be found (but usually are not) by repeatedly suspending the faces in water and decanting and examining the sediment with a hand lens. On the whole however the examination of the stools for trichinae is not at the present time regarded as a valuable and to dangnosis, and Hall (1937) states that the weight of evidence is to the effect that it is of little if any value

As other aids in diagnosis, there are the search for trichina larvae in the blood and cerebro spinal fluid the skin test and precipitin test and the bloopsy method for the examination of excised tissue. As regards the blood and cerebrospinal fluid examination, the larvae may be present beginning a week after infection although they are not always easy to find. The cerebro spinal fluid should be centrifuged and the sediment



110 110 -17 -17 Ministra spiralist (D tg.c.)

examined They may persist in such locations throughout the period of larval production by the females in the villi and have been detected in the blood in some instances over a period of 3 weeks. Also it must be borne in mind that when they are looked for too early or too late they will be absent even if the case is clinically trichinosis. The biopsy method has the limitation that it is negative in the early stage of the disease and even when trichinae have just arrived in the muscles they are much less likely to be detected than when they have had time to grow and encyst However this examination is often very valuable in diagnosis and gives dependable information provided the biopsy specimen comes from an infested muscle. In connection with the examination of the muscle of the patient it is advisable, if possible to secure some of the suspected meat eaten and also examine it for encysted larvae The specimen from the patient or animal may be teased or pressed into a thin layer between heavy glass slides and examined with the 34 inch objective. If no cysts are found chop up some of the meat and digest over night at 37 C in artificial gastric juice (o 7% pepsin in o 3 per cent HCl) Then put the material in the Baermann funnel apparatus and after a few hours examine the fluid in

It should be emphasized however that pork must be cooked for a length of time proportionate to its weight in order to insure the permeation of that to the center. Experiments have shown that at least 30-36 minutes boiling should be allowed to each kilogram of weight (2½4 lbs). Hurried roasting does not destroy the parasites as long as red or raw por tions are left in the center.

Salting and smoking of pork are not efficacious unless carried out with great care

Augustine (1931) has shown that quick cooling to -3.6 C or quick cooling to -8.0 followed by storage at that temperature for 2.6 bours or at -3.5 C for 4.8 hours reoders the trachiane non indective. Cold storage for 20 days at a temperature of -3.5 C is required by the United States Bureau of Animal Industry for pork products to be used unconstant.

Public Health —Trichnous constitutes one of the major public health problems of today. It shigh incidence in the United States and a number of other countries indicates that fittle has been accomplished by propaginds against eating, uncooked pork or in the spicial treatment of pork which is to be eaten uncooked in Covernment imspected Laughter houses. While the inspection of pork formerly performed in the larger slaughter houses undoubtedly reduced the amount of the disease. Stilles has empha sued that such examinations are not entirely dependable and set up a false sense of security. Moreover the most dangerous source of infection is pork butcherd on farms and in small local establishments which are not inspected. A number of epidemics have been traced to such pork from country slaughter houses.

A very dangerous and wide spread custom which leads to the dissemination of the dissease is that of feeding raw gardage to hogs. Nearly 40 per cent of the cities of the United States of over 4500 population and 50 per cent of the cities of over 1500 despoes of gardage by feeding it to hogs. The rate of infection is highest on the North Atlantic Coast and in California where hogs are most extensively feed on partings. In the Middle West where hogs are most extensively feed on partings. In the Middle West where hogs are generally allowed to roam the fields and woods and do not have easy access to latthen scraps or the rather scraps.

W Naught and Zapat r (1941) believe that rodent control is a statishically verifiable method of reducing trichmous percentage in garbage-fed swine

Hall (agy) has found that g thape fed wome have truel; as between g and g times as frequently as of grains fed swise and them or respectly hympotrant as a source of human trich moss. Truth moss in source of suparating the categories are supported by the categories are supported by the categories are supported to the

In vex of the clacks it is exceedingly desirable in places where it is believed to be conomically necessary to feed garling to big that it should be colored with steam or boiling water. The city bright do partners should not only problem the feeding of uncooked city garling on municipal hog farms but should also probabil its sale to private contractors.

be positive with certain dilutions in it days or according to Spink and Augustine (1935) in 14 days It has been reported that the tests may remain positive for over 7 years after clinical recovery Also it has been found by McCoy Miller and Fried lander that in a series of 124 cases in rural Louisiana heavily infected with other nema todes (chiefly Trickuris) but probably free from Trickinella 62 per cent gave positive reactions presumably group reactions. Thus while the test promises to be of consider able practical value a positive result is not conclusive particularly if other parasites are present. A positive precipitin reaction has also been employed but appears too late in the disease to be of practical diagnostic value. It usually does not become positive until the end of the fourth week after infection and it may remain positive for a year after the infection Bachman and his associates (1934) report various conditions which give nonspecipe and anomalous reactions

Treatment -The treatment employed can only be symptomatic and of a general nature for no specific remedy for trichimiasis is known. The adult parasites in the intestine are difficult to dislodge since they may bore deeply into the intestinal walls. Nevertheless when gastro-intestinal symptoms follow the eating of pork which was not well cooked, an attempt may be made to dislodge them by evacuating thoroughly the gastro intestinal tract Castor oil may be given at once and followed shortly afterwards by magnesium sulphate Chandler suggests that tetra chlorethylene or gentian violet should be tried to dislodge the parasites Often however the infection is not recognized until the larvae are migrat ing through the body This is the most critical stage of the disease and if the patient can survive the toric products of what may sometimes be millions of migrating and developing parasites until they reach full size and become encysted the critical stage is usually over

Beard and DeEds have reported some success in reducing the number of larvat in the muscles of experimental rats by administering sulfanilamide" and sulfathianne Someren (1939) reports that he was able to reduce the number of adult parasites in the

intestinal wall by feeding butolan (Bayer)

Wantland (1934) has shown experimentally that calcification of well formed cysts can be hastened by administration of cal jum and ergosterol Von Brandt (1938) has found that such calcification can be hastened even more by large doses of parathormone However Perez points out that this is not wise in man as calcium deposits form before any effect on larvae is noted

Prevention - Personal preventive measures against trichinosis are simple and consist in abstinence from all pork which is not thoroughly Numerous experiments show that trichinae are killed usually when the temperature reaches 55°C (Ransom and Schwartz) More recently Otto and Abram (1939) found in their experiments that a few trichinae apparently tolerated 55°C for 1-5 minutes and that 7 out of 1000 in one experiment apparently tolerated 60 C for 5 minutes They regard these slight discrepancies as the result of the differences used in exposing larvae to the infected temperature

Ransom and Schwartz pointed out that the larvae are quickly destroyed by exposure to a temperature of 55 C gradually attained 55 C is the minimum temperature which quickly kills practically all larvae The Federal Government requirement of 137 F (58 3 C) in the heat processing of pork offers an adequate margin of safety

Andes et al (1941) who administered this drug to 8 persons in whom the diagnosis had been made within 3 days of the onset of symptoms reported complete and imme duate recovery

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Nelson (1939) suggests as an additional measure of protection that skin tests on all hogs should be permitted and that in those giving positive reactions the meat should then be especially refrigerated before use. In a series of 211 hogs tested by this method in 97 per cent the results comeided with those obtained from microscopical examination of digested diaphragms. Whether this method is a practicable one and thoroughly reliable is not yet known

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Enterobius vermicularis in Household Parasitol

Chapter XLIV

ANCYLOSTOMIASIS

and Other Intestinal Infestations with Related Nematodes

Definition -Infection with the hookworms of the family Ancylo stomatidae

HISTORY AND GEOGRAPHICAL DISTRIBUTION

History—It is very probable that hookworm disease existed in Egypt in the remote past and it has been claimed that a disease mentioned in the Ebers Papyrus was of that nature—It was also mentioned by Avicenna the Persian physician (980-1037 A D)

Fronth in 1786 found hookworms in the for and named them hookworms from the hook like had of the expulsive burs. He proposed fee this parsate the generic name of U ceres. Here since the genus Uncc ero was preempted for the hook wearn of the for it was not valid for the burnan spaces; and we query dearched. The nist accurate description of the burnan parasite was given by Dubnin from material obtained at an autopy. In 838 he noted that these worms were generally found in very anatemic cases and that the mucros of the doodnam or jegun in where the para state were found frequently showed junction themsorrhage. On account of the 4 ventral teeth projecting from the mouth of the memade he gave it the name Agaby is me or more correctly Archiveless. Gavy X hook and e now mouth.

(spi md of more correctly Annylsisms ($\Delta \gamma \chi \lambda$) book and σ some mouth). Billhart ((53)) and Grienapre (52) are Grienary spike for a severe form of chlorous very com son in Egypt. In 1866 Whichere con meterd books norms with a 4 season in B and called epidece. In 1878 Grass and Parcota noted that the di case could be diagnosed by the finding of the characteristic egys in the atools of notients.

Perroncito in 1879 made the important discovery that the severe and fatal anaemia which was prevalent among the workmen employed in the construction of the St Gothard tunnel was due to hookworm infection. It was especially through this demonstration that the importance of the parasite as a pathogenic organism became recognized.

About the same time it became generally considered that the ameetus which affected workness in a number of muse were of a smaller nature. Ferronation (ASS) reported the development of the few hung first stage larvee batched from eggs and their metamo phoson into filasticions has as while Localizations in Sky found that mature Glamotron larvee when introduced by the mouth 1 to the intestinal tract $d=d\cdot p$ into adult prastices in the small intesting:

Lóos (1897) in Egypt first accidentally infected himself by placing disardorm larace upon his sian and later by experimental studies on the dog with inejestoma commum he demonstrated the complete route of migration and the stages of developen at of the parasite from the time of ris cutaneous invasion and passage through the lungs up the respiratory text over the englotts and theme downward into the small intestine

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Islands of the Carmbean Mexico and the southern states of the United States. The inhabitants of many of the islands of the Parific are heavily infested. It also occurs on the north coast of Africa, central and south Africa, and in Australia.

The table as about on p 133 illustrates the rate of infection found in approximately go per tent of over in a bumber of surveys usually following simple in conceptual as minution of the stools. No doubt light rates might also be found in surveys per formed in a number of other most true in regions. In the United States for example Smills (1934) in Alabama found in oper tent of those examined infected and Mannou.

Babt 1930 Style in some districts in Januaca the whole population is infected. Chandlet (1939) and Faust (290 have referred and chail to the different geographs and distribution and prevalence in one containes of the 2 percess Ancylotion distribution and Acadra amenda in However either hath speces as te found in the same country and Acadra amenda in the same country and the same
In the United States Keller Leathers and Densen (1949) goint out that the rate of infection of hook worm in 6 of 8 of the Southern States was 36 6 per cent from 1910-38. In the latter seried, the states in the order of previet e c of the disease from a gheat to lowest were as follows. Illusiosupply South Casolina Alabama North Carolina Kenticky and Tennessee

Zootocy

The hooknorms are classified in the Superfamily Strongyloidea

In this superfamily the male has a caudal bursa a prehensile sort of expansion at the posterior end for copulatory outposes

The mouth is usually pro-ided with six papillae and at times with a chitinous armature. The oesophagus of the adult is without posterior globular bulb but may

be greatly swollen

Tambier discussed Arcylotromatid e in which there is a well developed caudal burst and buccal capsule speriture of buccal cappule sparied by cutting plate or teeth. Strongpildas with well developed caudal bursts and buccal capsule aperture of latter go need by a cross a radiata. Trobsotromyful e burstyng a well dewe with a poorly developed to the manufacture of the property of the control of the property of the control of the property of the property developed and bursts having a typical rays and burst cappuler above the developed. The human bookworms belong to the family accurately are the property of the property

The oval cutting organs in the species of the genus A colosioma consist of tooth

like processes while in the genus A cater they cons st of aemilinar plates

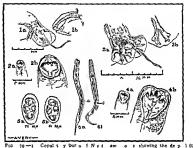
S trifica ce - The hookworm infections of man are nearly all due to two species Ancylosioma d ode of the Old World toectes and Accolor one to us the New Would species In fact both are widely distributed throughout tropical and subtropt cal regions and are found in temperate regions in mines tunnels or other localities in which they find warmth and moisture. The adult worms are found in the small intextine (jejunum) of man aometimes in enormous numbers (1500 or more) They attach tl emselve to the mucosa from which they suck blood and cause a me free bleeding a esult of this blood loss perhaps of secondary bacterial infect on and possibly also by the sec etion of a to in they may rive rise to a severe (hypochiomic) anaemia weaknes general debility and chion c ill health with retardation of development of injected children Very severe infections may be quickly fatal. Many c ses however are tractically sympt miess. Newcomers into n ndem c a ea usually suffer more ev rely than the native population which has acq and some immunity to the pay site or to its effects. Recent atudes ba e shown the great importance of a deficient diet the p oduct on of the snaemin which can's m times be rele ed by the administration I la g d s s of tron without el minat on of the parasites. The use of anthelms ties a important especially in connection with ultimate cure. The hookworm constitut s a maj r publ c health problem in many infested regions. In some localities over oo per cent of the population are infected

In the intestine the parasites develop a mouth capsule and become attached to the intestinal wall. After becoming sexually mature and mature ovinosition takes place.

It was recognized that the disease was very presalent in the southern United State is long got as 15g as as shown by the writings among others of Duricas show that the frequency of anaemia often associated with directing among the slaves. He dis described the orderstools legs the postuberant belly and carbiar goldination. State emphasized that the disease was probably of frequent occurrence in the southern United States and after a study of material sent him by Sinth and Chyston the United States and later by Ashford in Purcht Roco be in 1900 recognized that the species of bookworm common in this country was a new one. He first described and named it University among mentioned but as the genue Fluentura had been precepted for the hookworm of the fox as above mentioned it was not sald for this new species and the many was later changed to Include on many and later changed to Include on many and later changed to Include on many and later changed to Mention was more than the changes of the lates of mentioned it was not sald for this new species and the

Geographical Distribution —Hooknorm discuss is nidely diffused and may be not occur in practically all tropical and subtropical countries. If honever is usually rare in temperate or northern countries except in mines or unneit where sanistime is poor and suitable conditions of warnth and mosture east. Thus it has been the poly Italdane to be the cause of acverancement an Commit mine and in parts of Religion It is more common in the south of Europe It is extremely prevalent in India and Exprit as well as in China and other parts of the far Last II is a very important infection in Puerto Ricco and is common in the Philippine Islands. It is extracted databated in South America especially Brain as well as in Central America the

Country	Percentage	Author
Africa Egypt Rural population Egypt Victoria Nyanza Uganda Bilani Amizeona Colombia Pasania Menico West Indus Cuba Hondura Parter Proc	60 50-90 40 5 91 1 95 2 48-88 80 4 80 51 79 2 73	O Connor Scott N P Jewell If L Duke DaMatte Ilenao & Toro Villa Rockefeller Com Voillet Careno Spear No Barlow Rockefeller Com
Granafa Japan Locoboo Phihippines Borneo Samoa East Indian Islands New Gunea Indo China Siam du Nord Assam	84 3 52 59 85 1 83 75 3 39-62 94 3 93 0	R P Cockin Hoki Garrison Christe & Ledingham D Connor N Clapier Vath a & Leger W F Kerr A C Chandler Chopra



a wine the Franch of the down I ave and the porties to the them in the whom give the one of the jets to true at an a glebab Se les lynum by Bruch sold down all a Could try burns. A cycle who and at I have a lab The sea the mark of a Could try burns. A cycle was a darf i have had not been a considerable to the mark and the mark a

Hand it dood comes not contact with the kin at analytic probably by the x rath the larvae become very active and he near he sight is \$ x cause; it for fainting symptons of ground with App rently say part of the skin can be presentated and only a few manutes are required it rie process. The interdigntal space of the fest are come and a state of the state

1254 ZOOLOGY

The eggs which are passed in the facces are not infective for man. They batch in soil and water later after moulting developing into filaniform larvae which constitute the infective stage for man.

Ancylostoma duodenale (Dubun 1843) originally an "Old World species has spread over large parts of Africa (especially Egypt) and Asa It occurs in limited areas in North and South America. It also has been found in the gorilla, tiger, civet cat, and has been experimentally developed in young does and cats (Blacklock, 1958).

The male is about so mm long and 0 s to 0 5 mm wide the fensia shoult is by 6 mm. The secre are easily differentiated by the shape of the tail pointed in the fensile broadened in the male into an umbrella like expansion the copulatory burst The large oval mouth has four class like teeth on the ventral sade of the buccal cavity and a knob like teeth on the dorsal aspect. It also has a pair of ventral lancts belief which secretes a substance inhibiting congulation which is discharged through a domedian cone. The antenior end of the body is she tent rather shapity in the same direction as the general body curve. In the fensale the vulva is located in the posterior land of the voting is surface. The couplistory bursts of the mile shows a shallon cited the end of the voting is surface. The couplistory bursts of the mile shows a shallon cited the end of the voting the projection. There were distinct har like copulatory bursts opposition the worms gone as a to form a Y shaned first opposition.

a Y shaped figure

The females after fertilization give off great numbers of ova variously estimated
at 6000 to 50 000 or more per day for each worm. The ova measure about 40 by 600.

They have a thin shell a wide clear glassy outer zone and a granular central some which
(in freshly passed facees) is usually divided into 2 to 4 (never more than 5) cells

Necator americanus (Stiles 190), the New World species although first discovered in the United States appears to have been native in Africa and was probably brought to America by negro Slaves. It bas also been found in the pygmies of the Eastern Congo and in Rhodesia. It is wide spread in Northern South America the West Indies in India. Ceylon the Malay pennsula the Philippines and the Pacific Islands. It has been reported in the pig and from several species of monkeys. It differs from Ancylostoma duodenale in the following points.

It is slightly smaller ribe make measuring 8 by 0 g mm: the female ro by 0 s mm. The bucked cavity is smaller round and its equipped with a prominent ventral channel projects compared to the bucked cavity. The median dorsal case projects compared usually not be bucked cavity. Deeper in the cavity are one part of dorsal and ventral lancets or pharynegal teeth. The antenor tip of the body is bent back sharply in a direction opposate to that of the general body curve

bent back sharply in a infection opposite to that of the general rooty circums. The volves is in the anticror balf of the body. The caudal bursa is deeply cleft and the terminal portions of the dorsal ray are bipartite instead of tripartite. The spicules are fused at their tip and end in a single barb. The own are slightly larger (ab by rook)

The life history is practically the same in both species. Segmentating of the of does not progress within the untestine probably because of late of oxygen. After leaving passed in the presence of warmth (i.g. to gr. preferably 27 C) mosture (mode) water damp earth) and oxygen segmentation progresses rapidly so that within two days a small rholdstifern larvas shatched. (Porddifferentiation seep 1280 and Fig 279) This feed worscausly and grows rapidly reaching a length of 0 g inm on the third when it moults again loses the bulb his sellings of the osophagus and as converted into a filer form larvar the infective state. The old cittle is not shed but its retained as a protecting sheath. The parasite the internal contents into a resting state in which it excess to take food althought it remains actively made to the content into a resting state in which it excess to take food althought it remains actively

The negro race does not suffer from the rafection as does the white. The former appear to have an immunity but often serve as carriers of the disease Kell r Leathers and Densen have made a comparison of the incidence of hookworm infection in 17 448 pegroes and 50 028 white persons in the same counties in the southern United States during 1930-1938 The incidence in negroes was about one fourth that in white individuals and the average intensity of infestation was about one ball that found in

There is a difference of common as to the length of time the parasiles may live in man in the absence of reinfection. Some consider this period one of a few months others of 2 or 3 years. It has been considered that a case leaving an infested region

will get rid of his parasites within 7 years

Nowhere in the world has the study of hookworm infection been pursued so intensively and carefully as in parts of the southern United States This work was begun on a large scale by the Rockefeller Sanitary Commission in October 1000 with Dr C W Stiles of the U S Public Health Service as Scientific Director

Among the specific objectives of the Commission was to make an infection survey with an active and reliable estimate of the degree of infection by counties to make a sanitary survey which should show by counties the condition of soil pollution respon sible for the presence and spread of the infection to demonstrale to the people that hookworm d sease was a serious handicap that it was curable and preventable to belp the practicing physicians of the state in diagnosing the disease and controlling it to make definite measurable reduct on in the degree of infection for the heavily infected areas to make definite measurable increase in the sanitary index of these areas and if possible to help lay the foundation of a state and local health service that should in the end take cu e of hookworm infection and other preventable diseases

Keller Leathers and Densen (1040) have summarized the success of this work in 8 of the southern states during the periods 1910-14 and 1930-38 They report that in the early period 577 500 specimens of faeces were examined and in the later period 424 SFF The numbers found positive in the early and later periods were 240 895 and 8r or3 respectively

After adjustment for the distribution of the population, the percentage found positive in 6 of the 8 states was 36 6 per cent in the earlier period and rr 2 per cent in the later period resulting in a very striking reduction

While there is still a widespread distribution of hookworm the areas of highest incidence are confined to the coastal plain and sandy soil areas of each state

The age distribution shows that the greatest prevalence was in the group 5-19 years of age. The peak of incide ce 24 5 per cent was reached in the age period 15-10 In the preschool children and adults the incidence was about one half as great as that found in the school age group

Scott (1937) in the study in Egypt of the data from 2 000 000 hospital cases and from nearly 40 000 persons examined in their houses found that males and females acquired infection at about the same rate up to the age of 10 In females the maximum is reached at 20 years and in the male at 15 years. The males are always more heavily infected. The accumsition of the infection was markedly associated with field work. In Egypt the intensity of infection as shown by egg counts is everywhere very low as compared with most countries Scott believes this to be due to the low soil infestation intensity

on the 54th 55th and 57th days. He thought that in such instances between 295 at the larvae penetrated the skin. By treatment he recovered adult worms numbering 27 7 3 and 38 respectively from their faces.

The exact duration of his of the adult parasites is not precisely known but probably values from a few months to 8 years. Infection can also occur if the larvae are sail lowed. Fulleborn showed that in experimentally infected animals a few larvae tan

reach the intestine without passing through the lungs

The number of parasites which must be present to produce disease is visuodly estimated and doubtless varies greatly. As a rule, it is said it probably require 500 borms several months to cause severe symptoms. However, much depends upon the resistance of the patient. In some cases it is believed that 15 womes or even frest may cause definite disturbances. There is frequently not a close parallelism believes the number of worms and the seventry of symptoms though Darling taggeted the reduction in the haemoglobus sextend proportional to the number of worms great the



Fig 180 -Ovum of Ancylostoma dued note (Alt 1] A Taotison

Epidemiology —When faeces containing hookworm eggs are deposited where conditions of moisture warmth and shade exist they develop into the infective stage a filariform harva which is the non feeding but motile larva inside the cuticle formed by the second moulting. While eggs and jounger larvae are killed rapidly the encysted larvae withstand partial drying for considerable periods.

Subsapered that the more favorable condutors for development are na porous anoly and matter than an a clay one. Where a reverges spation exists there is very lattle danger of the spread of booknown disease and the same as true where there is proper disposal of the faces by burning booking or treatment in a spott tank in rural distincts however where the atool is often deposited in the shade and returned of a clump of trees the so old bronces instead with myrated of lavves to that one states subsequently with hare feet on such a spot easily becomes infected. The varies of the states o

lesion termed creeping eruption on account of the slow development and migration of the larvae. This condition is referred to more in detail under symptomatology

When the hook norm larvae in transit break out of the pulmonary capillaines into the aircs they may produce minute haemorrhages and in instances when large numbers of parasites are migrating larger haemor rhages may occur in the air sacs followed by round cell infiltration. Honever the lessors and symptoms of pulmonary irritation with hook worm infection usually are not as severe as have been noted in Ascaria or Somethodes infection.

In severe cases of hookworm infection pronounced angenus with yellow war like skin is a feature but emacuation is rare and the sub

cutaneous fat still remains. In heavy infections there is frequently ordema. about the ankles Especially in the lower part of the duodenum in the sesunum and upper part of the sleum small punctate haemorrhapic spots or larger haemorrhages from the size of a pea to that of a half dollar are encoun tered. One or several worms may be found in the center of these buerror thagic areas. In fresh autopsies the parasites are found still attached by their mouths to the miseous membrane In other areas patches of punctiform nigmentation are seen the result of older haemorrhages In sections of the tissues injured by the bite an infiltration of eosinophiles may sometimes be ob-Bonne (1037) has recently re

ported at thustai lesion which was observed in 3 cases in Malays in Java where the priasite Incitostoma bra it iense actually invaded the submucosa in causing peritoritis and death (seep 1272)



ported an unusual lesion which was (life at) closes in womas and r
observed in 3 cases in Valays in Java f
to the at his linuous at d
me
(By ff res)

seese actually taxaded the submucoss in the small infestine in one case causing personnis and death (seep 1272). The beart may show distation and the musele is often flabby and may reveal fairly degeneration. The lover and kidneys also usually show fairly changes. The spleen is often reduced in siz. Microscopiral examination of ections of the liver and kidneys may show the presence within the pracredy matous colls of grains of yellow pigment giving reactions of his matodia indicating an intravas cutar blood destruction in which harmofishs, has been a factor.

There are different views as to the manner in which the symptom of the disease and the resulting anaemia are produced by the bookworm

Thus it has been suggested that the anaemia may be brought about by (i) the choice loss of blood (2) the abus pinos of a size fic betweenly c toum (3) through repeated bact rial of closur trought his ns p fured by the paras te in the inter

While the careful studies of Keller and his associates in the United States show that a substantial reduction has occurred in the incidence in each of the southern states in the counties studied since the investigation and plan of control was instituted by the Rockeeller Saintary Commission in cooperation with the State Department of Health nevertheless the disease has not here adequately controlled in many areas.

The reduction in moid nor has been greatest in those states in which suitable sold areas are most limited in extent and the chimatic factors are less statisticately the development of hooksoorm larvae. The discase has heaft reduced in these states to a level which now may be regarded as resultail shookworn. However the great value of these sanitary campaigns is demonstrated by the fact that even in those states were all the conditions are favorable for the speace of hookworn have the greatest where there has been a sustained effort for its control since the problem was figratest where there has been a sustained effort for its control since the problem was first taken up by the Rock-fellor Sanitary Commission.

Otto and Kerr (1930) have been carrying on for some 14 years experi mental studies on canine bookworm infection in connection with the question of the biological control of the infection by the host. In a recent report 3 litters of dogs a total of 10 animals were used to demonstrate the sharp difference between the active immunity to hookworm resulting from serial like infections and the partial refractoriness of mature dogs to initial infections From 52 to 203 worms were recovered at autopsy from actively immunized dogs given test doses of 120 000 to 00 000 larvae whereas the unprotected litter mates produced 1263 to 31 00 worms Furthermore, the unprotected animals with one exception succumbed to the test infections whereas the immunized animals were scarcely dis turbed They have been led to conclude not only that the phenomenon of actively acquired immunity operated in the host parasite relationship of the canine host and the bookworm Incilosioma caninum but that it is apparently by far the most important natural means of host control of the infection

PATHOLOGY

The site of entrance through the skin of the filariform larvae is often characterized by a dermatitis which has been called ground itch or foot itch by reason of its frequent location in the foot which has come in contact with the faeces polluted soil. The symptoms consist of intense itching and burning often followed by oedema and cythema and later by the development of a papular or vescular eruption. The dermatitis due to infection by Aecator usually disappears in about weeks unless some secondary infection occurs. However the skin invasion by Ancilostoma disadensic does not always give rise to dermatitiss and ground tich is not found in Egypt where ancylostomassas is rife

Other cutaneous lessoos also frequently result from exposure to the skin to filariform larvae especially of the species A bra ilense of dogs and cats and Anglostoma canimum perhaps also the human strains. The lessons coasist of the production of serpinganous tunnels in the sintum germinativum sometimes followed by an erythematous vesscular or papilar.

Whether the counophila as an evidence of a production of a town as not clear. However the counophila may be due to the irritation of the passage through or presence of the larval forms of the parasite in the skin. Nevertheless there is still some differ ence of opinion about the production and effect of a town in regard to the anaemia. In addition, fully date has been pointed out as one of the chief causes of the anaemia.

Delangem. 936 has part colorly emphasized that dot and general hygiene have important contributary effect on the development of the se ere anismas. Duet poor in protein and lipioid substances (which are essential for red cell regeneration when extra vascular holded loss is continuous) obviously may infidence the aniemas especially if there is deficiency in the gastine ja ce. Stewart has emphasized that heavy nematode indetions les or protein digestion. Apparently such poorly nounded individuals are also less resistant to infection. Another factor individual resistance i important Manson Bahr (redo) possition of that many inhabitants of tropical countries are in a state of chronic starvation living on coarse bulky unnutritions food and are prone to distants of its formach and in the standard and dispepted troubles. It susch individuals any additional cause of mainstrition as the presence of a very large number of oney/down and a the though perhaps must like or 6 hood may be sufficient to turn the scales against

Castle Rhodes Payne and Lamson (1914) in a study of \$5 patients with books own aneman in Poetro Rice thought the anaman is add en mainly to unsufficient blood production as a result of a deferency of awa hable iron and other harmstopectic substances in the body. This deferency as postulated to be produced by multiple factors defective d ets or indirectly by gastro mentional changes or by blood loss due different patients. No effect of the presence of the hookworm could be demonstrated other than could be accounted for by its ability to remove blood from the patient. The removal of the bookworm was shown to produce slight cf. call improvement and to have considerable effect apon red blood cell prod ction but to have little effect upon harmsglobus productions with a several weeks. The daily administration of 5 gamm of ferrie ammonium citrate with or cometimes even without removal of the parasite real active day by it many improvement and the several weeks. The daily administration of 5 gamm of ferrie ammonium citrate with or cometimes even without removal of the spersarts.

It seems clear then that in many cases of bookworm infection when iron and liver are added to the diet the anaemia may be greatly reduced. Scott (1935) points out that it is not the number of bookworms that determines the onset and degree of book worm anaem a 50 much as the boots aron reserve.

Character of the Anaemus —The anaemus is often the most prominent symptom in hookworm infection and is generally recognized first by the pallor of the mucous membrane. It is accompanied by the usual symptoms of weakness fatigue palpitation and dyspinces. The children are often physically and mentally backward—puberty may be delayed Often the abdomen is distended and rapidly developing asthema may occur. Ashford and Panjes (1933) noted gross intestinal heamorrhage in several cases. The anaemus may reach the most severe stages quickly but in other instances slowly. It has usually appeared by 10-0 weeks after infection. Eventually a severe grade of secondary anaemus usually results. The anaemus is hypochromes and usually microcytic in character. The haemoglobin content falls first and later the number of red blood corpussies. The color index is always less than 1 in severe cases.

Fixth a d Ghal ou gui fou d that the average total blood volume in cases of ancy lostomians was 70 5 cc per kg body weight. However the average plasma volume in a cylostoma anaema was 60 6 per kg so thet the diminution of the total blood vol me could be accounted for entirely by the diminution of the red blood corpuscies.

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tine and (4) through unfavorable dietetic influences. In many severe infections the chronic loss of blood due to the direct action of the parasite nould appear to be an important factor in the production of the graenus.

Froduction of America — Lying in the inuces the adult worms intessure, from first min in length fresh larget wone blood and afflough the amount deave by a single worm daily is comparatively small (and has been roughly estimated by Valid on yor. Wells of Sec. Sai Ry (1921) of Ser. and Faust 1920 of yor.) that seems abstracted by thousands of parasites continued day after day for long prouds of time would appear to be an amplie explanation in many cases of the resulting anomal. Also in feeding the parasites more from sit, to site and the bleeding may continue the title of the title of a considerable period after the norm releases yis foll on the



FIG. 283.—Long bud nat section through a bookworst attached to the initial numerous about d down after the doubt, of the carrier. A port on of the inhumenous cost is down into the bouted carriy and teads along cord it is into the to book carriy and teads along cord it is into the to independ in which 4 small I saue no he are still discernible. Section box sum that I from More 2)

minors and moves to another spot. Therefore it seems abvious that a continual has of blood occurs by the feeding of the variant in his way as has been especially demonstrated by Wells (1921). Nobe (1933) and Fulleborn and Kinth (1920). However because in some access the anamies scena to be fore great in proportion to the blood and as not always in proportion to the number of parasites present some observer must there must be another factors are used to be a not always in proportion to the number of parasites present some observer must there must be a not-feet factor in the special proportion and the same may be due to tours secreted by the parasite which either dament and anamin may be due to tours secreted by the parasite which either dament of the contraction of the same of the same proportion of the same parasite shade the demonstrate by the same harmonity as substance produced by the norm although some carlier investigations in test tube experiments showed that a kancingly on see present

It has been pointed out that in Creep us eruptions the irritation about the large in the skin might be due to a torus but the presence of batteria secund the larges which might base caused the irritation has not been excluded in such instances.

the individual gains in weight and energy and shows improvement in montal acuity (s) Mild cases with moderate degrees of a semi-the harmoglobul precentage ranging from 55 to 75 per cent. In these cases there is rather marked epigastic tendences with frequent attacks of and entrottations. Candiac aplitation and a tendency to shortness of breath may be quite noticeable. Headache and vertigo may be pre-ent (s) Severe cases. In such cases we may find extreme anaemin with harmoglob n per centages around 55 et even as lon as 15. These cas is suspity are very useful and plow of the centages around 55 et even as lon as 15. These cas is suspity are very useful and plow of the centages around 55 et even as lon as 15. These cas is suspity are very useful and plow of the centage around 55 et even as lon as 15. These cas is suspity are very useful and plow of the centage of th



Fig. 283 — Pt] f cylstm Rd 11 2 ro oo Hb t5 Wit ut 0400 E nophle b nt Upper part of mall ntestn s 1 d with k worms (Pom USN 1 Mdc1 Hull ta)

k own crassing being that fo earth (Picx or geophagy) Other p tient r chalk wood c tion etc.

As regard the sugg stions of Smilhe and Augustine to class fy hook wo microses as

carriers where he in the roll worms harbored data is exect too a day partet, when the adult worm exceeded on Sites e.g. seed that such a comput to based in gg co is may measure objectic eyemptoms be the int will not be guider treat mention. Here it subjects eyemptoms are more in the dead of eyemptoms are more in the subject eyemptoms are considered. The subject eyemptoms was the subject to the subject in the su

Villela (1037) found low values for plasma proteins in some cases. The average red blood cell count varies greatly. Surrez (1033) in the study of 10 cases found from 1 000 000 to 3 500 000. Bi gam and Ghaloquang ure z 500 000 on 3 an average count with a haemo_lobin of 27 8 (Sahh) in 100 cases in which the average diameter of the blood corpuscies was 27 44. The reticulorytes were always less than 1 per cent of the ever San Rvo found them increased after the third week. Landsberg (1937) found that in sector hook aror maneams of dogs which later was fatal there was a mathed-reticulorytosis. Eo inophilia is usual and may reach even as high as 50 per cent. Surret (1033) found the cosmophiles varied from 2-15 per cent.

Lichtenstein (1036) found

Haemoglohm	Average Percentage
Per Cent	of Eosmophiles
Between 70 and 60	32
Between 60 and 50	23
Between 50 and 50	10
Between 40 and 30	ır
Between 30 and 20	2 5
Below to	•

From these studies it would appear that the more e-ere the anaema the smaller anabet of cosinophiles and that in very severe cases they may even disapper estirity. Whithy says the council has a sperimental volunteers found cosmophila present the third day after the inference of the same of the same and the state of the same and the same and the same after the fifteenth week. In these three volunteers 300 filanform larvae were placed upon the skin. The number of worms which penetrated was 325 427 and 321. The

upon the skin. The number of worms which penetrated was 295 297 and 291. The number of adult worms recovered in the facees from these cases was 83, 78 and 77. In regard to the leucocytes Suarez reported counts of from 2500 to 100 per mm there may be a general fall in their total number later but there are no other

Gastine Sections—The gastine secretion has varied Rhoads and Castle (1921) state actions man On the other hand Biggam 1934 rately found

any deficiency of free hydrochloric acid

Opinions vary with reference to the presence of blood in the facces according to the
different method employed for its detection. When not obvious occult blood is
usually demonstrable.

Symptomatology

In a secondary anaemia with early and marked cardiac palpitation together with epigastric tenderness and a tendency to mental retardation and physical deterioration one should always examine the stools for hook worm eggs. The course of the disease is often decidedly insidious and indefinite and the clinical diagnosis notionously uncertain as shown by many reports where physicians of experience after examining a number of persons in a mill or school and diagnosing only or 3 per cent as showing physical signs of the disease have been astonished upon examination of the facecs of the group to obtain positive evidence of infection in 70 to 80 per cent of the number examined.

For convenience it is well to divide bookwarm cases into 3 groups (i) where the indicated person fails to show any special endence of abnormality the diagnosis restinated the state of the

ments of the larvae and the tasses trustation give mue to an intense pruntits with scratching and often subsequent juggents unfection. Round cell infiltration and accumulation of ensimplifies may occur around the tunnels. The parasites may continue their activates for several vects or even months but very rarchy mouth the circulation. The kenons are most frequently on the feet and hands. What end Dove and Maple stone (1931) have also studied the crepany expulsion the latter having observed it in cooles in India. Apparently these species of hook vorm do not find approps te physiological condutions in human beings for the continuation and deeper invasion of the tossies. The infecting parasite has sometimes been referred to as force may not Other forms of crepany exposure are leftered to in the chip ter on Diptera.

Symptoms in Detail.

Skin Manifestitions—The dermaints following the prestitation of the larvae occurs must often about the toes; or timer said of the vole of the foot. Althord found in a study of 19 000 books often cares in Pearto Rico that 05 per cent gave a history of instul dermaints. On the other hand in Ergyl where an yolotomass in prevalent anapylostome dermaints is not observed. Subsequently during the ingrat on and development of the parasites in the body an outcomed such my other The skin is the host of the pear of the body and outcomed such my other than 100 pears of the pear of the pe

Circulatory and Respiratory System...—Palpitation of the heart is early and marked Fre utonal immurate art frequent in the advanced stages. I clusters not fine neck venus is also common. The pulse rate averages about 10 and the blood pressure is low There is frequently some clistation of the least to the right. A long pulse pressure is common in severe cases. Shortness of lorenth on sight exercises in the most common induced by the intrastion of the larvees in the pulmonary already during the course of induced by the intrastion of the larvees in the pulmonary already during the course of the contrastion of the saves in the pulmonary already during the course of the contrastic contrastion of the saves in the pulmonary already during the course of the contrastic c

migration

Digistive Spitem—Epigistic tendences is very characteristic. The pair has sometimes suggested disolocial where The stomants is often distilled and the gisting une may be hypersoid. It has been suggested that the doss is to neutralize this socially with an alkali is the explanation of the due for fail alth-containing earth on the part of dirt exters. As the annexias increases the acidity often diminishes and archibydria may occur. The titude of the distilled of

Nervous System.—Hooknorm patients are often not only physically tired but mentally tired as well. The infection in children leads to a backward mental state. P tirnts have eny britle energy or initiative and a coften computered supply and 1 ty.

Hypocho driasia is at times noted and some severe cases become melanchol c

The Blood.—The red cell count averages us masted cases a root so to a good oor red cells per cut mm. The III by percentage 1 down in such cases to between 3 on also The color index is will below 1 except in certain rate cases which the color index is that of permicious standards being above. These laters caves are vij resultant it treat ment and sometimes show very few infecting worms notwithst indice the secretic fitted and the secretic fitted fit

The spicen and liver very rarely give in et any symptoms and while albuminuria is rather common in advanced cas a with oedema about the feet yet casts are but rarely fund.

DIAGNOSIS

Clinical Diagnosis —The diseases with which it is most likely to be confused are beriberi chronic nephritis and malarial cachexia Stiles See p. 1213 (Bonne)

It is in children that the most serious effects of the disease often occur there being marked stricting of the growth with a corresponding merial backwardness. Such children may show marked retardation and delay in answering the question asked them and often repeat it in a drawling manner. Tested by the Binet Simon method, one may find a 16 year old child to have the mental development of a 10 year old one, and at the same time, one may note that from a standpoint of physical development the child only seems to years old. As the child approaches adult age a striking lack of sevual development and the lack of pubic hair may be observed. In guts there is delay in the onset of the menstrual periods or these may never appear.

The disease often exerts a deleterious influence on pregnancy and in badly infected districts it has been reported as a common cause of repeated abstrious and missranges in pregnant evoices (the third pregnant evolution is not in the prompt desth often occurs. Impatred renal function has been an outstanding feature in the majority of pregnant women suffering from acceptanciases. Masson Bath points out that heavily infected cases show a predisposition to develop the toxicious of pregnancy such as prectainposis acclumpsia and neighbits toxicious.

In hook norm infection as a rule the temperature is normal throughout the course of an uncomplicated case though occasionally low lever has been noted and in the late stages the temperature may be subnormal. During the first neek or so johoning a heavy indection there may be pulmonary manifestations when the larrae are migrature.

by way of the lungs

The diagrams of a case. Sities attached much importance to a tailow yellow older of the das of the meas and to neched as well as to the sye attachmentation which we said to retemble the eye of a h or that of an intoracted person. He also noted that the purel tends to distact matter do for contract when the paties look at a direct site. Sitiet (o, o) thought that the condition might be rather nee of hoppus. Dimense again for severe cases optimized to the condition of the direct cases of the purel tends of the condition might be rather nee of hoppus. Dimense against as requestly noted and in exerce cases optimized optimizations of examination may be retembled harmorrhages. There may be may be may be had succeed cases.

Demastis—In from 80-90 per cent of cases there is a history of demastirs particularly of toes or feet, which has been commonly called 'ground itch' foot itch' or dew tich'. This is most frequent between the toes or on the inner side of the sole of the foot. The irritation of the toe the penetration into the cutaneous tissues of the hookworm larvie. The tiching is intense and secondary infections often occur as the result of scratching. Vesicles appear about the second day and are often applied by the scratching with a resulting pustular or impetiginous condition.

The shin and hat are generally day. The evidence of brain patches in hookwarm infertion is apparently much more rooman on exposite to 1-capie americans that Acquisines designated and with the latter parasite they are not often eccountered. A formed cerepting cruption that to expose use of the skin to hindrom larvaed of steplish forme for almite has been reported as occurring particularly along the southern United States coats. Kindy Smith and his associates 107-107, have especially studied this solection. In the course of a or 3 days after the skin has been exposed to soil containing the larvaer redducth telty papules appear at the site of the infection. The larvae by their movements gradually produce seripicanous tomacks in the stratum germinitivum. The licino in at first erythematicus but soon becomes estimated and weacular. The paranter more comared at the rate of several millimaters to a few continueters per day and shadom a part of the tunnels they have produced these becoming dry and out of 15th more.

at least too tunes or until a prefettly homogeneous suspension is obtained. (1) Central upgains for a minute at 1000 pr for (if the bottom of the tube is 6 s. or, from the centre of the ax). (a) Decent carefully (about a per cent of the ox a are lost with this sluid) (5) hearly fill the tube with 2 status red sails solution (500 fr it 750) and resuspend the sed ment avoiding air hubbles. (b) Fill just it the brim with the sails solution (c) Cartufully apply the cover aby such must took the duid and fit awayly on the top of the tube w thout leakage. A small a r bubble may be expected. (3) Centrifugalize as before: (b) Lift the coversity of quickly without titing (the ox a do not addrect the fights in this sails solution). (ro) Mount on a side m a horizontal position prefer ably on two small cones of plasticnes so that the field of does not touch the side. (7) Count all the ova using a mechanical stage and a magnification of 750. (13) Add a drop of sail touthous so as to refull the tube as in (7) and repeat the process

According to Lane on the average the first coverellp piesparation contians 76 per cent of all the own recoverable a of the second coverable p 28 per cent. By repeating (7) to (17) twice more an additional 3 per cent can be tree viered and the final 3 per cent by repeating the entire process with the final decented in (2). Lane reports that this procedure gives more uniform and mark higher egg count (than any other method distance).

The same procedure is applicable to T chis is and Ascaris ova but fully saturated

sait solution should be used

Gras 1 estimated that each gram of facees so tain d 5,0 a for each norm of which 25 per end are males and 75 [er end I males. Lane estimated that each lemile produced about 30 eegs per gram per day. The number of eggs per norm varies greatly is less in heavy infection a and at lest offers only a rough sppro-imation of the degree of the infection.

Coll at nef the tare a (Baermana appraatus a described by Cort et al 1912) is claimed by some workers to yeld postut ar suits in ne regul by than direct encentrat to m thods. To the tip of a large (8 inch) funnel attach a short piece of rubber tubing pro ided with a pinch cock. Fill the fun of leastly to the brain with narma sure and suspend on a suitable stand. Co er the funnel with a precedent of the other Cover the gause with a simple layer of towel. In the waters it is middle of the other Cover the gause with a simple layer of towel. In the waters it is middle of the other both by the faces (or soil) to be trated and unk must be to not the funnel. If a speer of see in placed on top of the sample it will basten their migrat on. Draw off a few co of water centrilegal as and examine the sed ment for fairs are (Differentiate from Singaple of ral parcy).

The d agnosis can also be made by searching for the adult worms in the facces after a vermitige. They may be found in cases in which o a are not demonstrable in the facces by the less efficie t concentration method.

Charcot I eyden crystals are often present in bookworm stools

An essi philia (10 per cent to 20 per cent occasionally higher) is usually present but is inconstant and may be absent in the se ere cases

PROGNOSIS

The disease is more serious in children than in adults on account of its interference with physical and mental development. The dark races do not seem to suffer as much as the white ones. Treatment is usually very beneficial but it those who are debulicated by other diseases or in those in whom the disease has assumed a perincious anaemia tendency the out look is not good. In expectant mothers with low haemoglobin percentage the prognosis is often grave.

The disease shortens the life of the people in an infected district and mikes them readily full victims to intercurrent diseases. Various sta

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notes that heavy Ascars infections may sometimes give rather similar symptoms. The signs of a multiple neuritis should differentiate benden and the presence of casts or high blood pressure. Chronic nephritis

The cutaneous leasons may sometimes resemble and must be distinguished from those produced by the exercance of certains Consistenems. The crepang empion of Ancylottoma bro disease is usually recognizable by the elevated tortunes character of the tunnels in the skin. It may however resemble the leasons produced by insusano of the skin by larvae of warthle thee of the genus Gasterophilus. Diagnoss of the latter affection may be made by extracting the larvae of the fly by massaging the skin lesson with oil or by removing it with a needle and examining it under the microscope and recognizing the black transa-reser bands of the skin and hody segments of the fly larvae.

In the Western Hemisphere creeping cruption due to Gasterophilus frequently occurs in the same regions in which A bra ilsense is encountered (Faust 1940)

Laboratory Diagnosis —The diagnosis can usually be made by finding hookworm of a in the faeces usually by simple microscopical examination of films without concentration of the faeces

However Hau and Chow (1939) who performed a senes of autopies in Chas found hookworms in 117 Of these stool examinations had here performed on 69 during life and in 44 of them no eggs were found. In 12 of the agregatives only midworms were found. This report emphasizes the care that must be taken in the duag mosts of many cases.

The eggs are oval and thu shelled with a wake clear glassy some separating the more or less segmented granular central portion from the shell if numerous they can be found easily in ordinary fresh sincer preparations by examination with the lower If the infections are very light concentration methods may be required to find the ovar For this purpose Barbers technique is useful. On a slide emulsify a hit of faces in equal parts of glyceria and saturated salt solution. The ovar into the surface and can be recognized easily with a \(^{2}\)ft inch objective. A larger amount of faces may be emulsified in this maxture and centrifugalized Put a way of cotton on the surface of the fluid. Pour on the cotton after canime on a slide for intangled eggs.

Pepper and independently Lane recommended the following leviation metals for economic to the control of the control of the process of the control of the con

tration of ova

Still; method of counting one in the faces is much used in estimating the heaviers of an infection and in checking the results of treatment. Weigh out accurately 5 cm of faces and add enough N/10 NaOII to bring the volume to 75 cm. Make a misform segmenton by a bhaking vigorously at least one mixed with girst beed. With a simple pipetic remove immediately exactly o 75 cc. put on 2 by 4 inch side and cover with a 22 by 44 inch cover ship. Using a mechanical stage count all the ova in the preparation. Multiply by 100 to get the number of ova per grain of faces. This procedure is farly satisfactory if ova are numerous but false entirely if they are sparse.

Late 3 DCF (direct centriqued) shorton 1 methed (1988) in regarded by many as the most efficient. This requires (a) special centridings tubes with distribution and the short of the meripensive and can be used with any centrifuge. Procedure (i) Measure exactly ice of facets (culture with Lane s special copper backet or by displacement of water in the (graduated) centrifuge tube) and put in the centrifuge tube. (c) Nearly dill the tube with water stooper and with the stooper down abake vagorously against the stooper soils and the defection habits of the people are the controlling factors in maintaining hookworm infection at a low level of intensity

In connection with soil transmission it is interesting to note that in the Transvaal where in many localities Ancylosomiass is exceedingly prevalent it is only found in alkaline mines and not in the soid ones.

TREATMENT

In the treatment of the disease at should be recalled that the hook worms take blood and so non from those who harbor them and this is the first step in the production of book-worm anaemua. This loss of blood and inor may be overcome through the body supplying the blood making marrow with iron from the food or from that stored in the body and this is the second step in the proce s. However when this loss of blood has gone so far that it can no longer be compensated in this way and in spite of this proce a scroud anaemia as present by prescribing from for the patient the anaemia may still be reduced even though the hook-worms may remain present. Rhoad Castle Payre and Lamson greatly reduced the anaemia in hookworm cases by adding from and liver to the diet. However in many of the cases with severe infection if not all the bagmon globin will either not return to normal or remain at normal unless the pursates have been first enrelled

Hence in the proper treatment of bookworm anaemia as in bookworm infection the first step should be the expulsion of the worms by treatment. Only in a very few cases with advanced anaemia who are so ill that it may be regarded as unsafe to administer an anthelminithic should iron be supplied first.

Anthelminithics —The drugs which have been used most extensively and especially tecommended for treatment of hookworm infection are (t) thymol (s) hetanaphthol (s) oil of chenopod um (4) carbon tetrachloride (5) tetrachlorithylene and (6) heryl resonanol

Thy is has been employed for many years and is still recommended by a number of physicians notably by Clayfon Lane (1923). The dosage recommended for an adult man is to grains (a girm) 3 d ses of ro gir each in ree paper cachets for an adult woman 45 grains and 10 grains in prepriamer. It should be gir in on an empty stomath and not given more than once a week. In advanced belan this saw this great debulty it must be used with great caution. For children ander 5 years the dose recommended it must be used an Cog area. I sum 5 no years 5 grains (or girm). At times the drug children with the state of the same of

Beta aphthol has been recommended in doses of 3-0 grains (0 2-0 65 grm.) In larger doses it exercises an irritant action on the kidneys and may give rise to acute

ing mm tion. Serious sequelae and even death have followed its use

Oil / ch sepid a was found by Daning and h associates (1930) to be more efficient in testing than throat Honever oil of cheep nod un to quite term and is now not recommended e-ept when gr en n c spacetion with rarbon tetrachloride or testashborethees for must unfections and n r and hookworn. The maximum toteranted dose of oil of chenopediums is 3 cc f r adults and 3 maintain per year of age that the contract of
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tistics give the mortality as from less than one half of 1 per cent to figures approximating 7 per cent

PROPHYLAXIS

The first measure is to diagnose infections in all cases and to insist upon the treatment of such persons. The proper disposal of the faceal material from hookworm patients is the objective point in prophylaxis Faecal contamination of the soil and water must therefore be prevented

The use of some type of properly constructed prive is essential as there is nothin more favorable to the development of the bookworm larvae from eggs to the infective stage than the practi e of defecating on the ground where conditions of porous sandy soil shade and moisture exist. Later on such a spot teems with infecting larvae and the person stepping there with bare feet is almost aure to become injected. For this reason the nearing of shoes is an important prophylactic measure. At the same time shoes are not a sure protection as Ashford has noted infections in soldiers who were good shoes and infection may occur through the mouth from contaminated food or water The faecal material should be buried not less than 300 feet from the nater supply and down hill from the same. The be t method 1 to use some septic tank process as the anaerobic processes of fermentation destroy the eggs

The Chinese method of storing night soil for months in large comented water tight pits is favorable for destruction of the larvae since under such conditions with hitle air the larvae soon die Honever it is important that there should be no mixing of fresh facces with earth The water supply must be carefully guarded from all po sible sources of faecal contamination. Drinking water unless above suspicion should be

Hookworm disease tends to disappear in tot us or crites where there is an efficient senage system. The disea e is one of the most conspicuous examples of soil pollution disease Some authors think Ancylostoma more diff cult to expel than Acce or

Scott (1937) in Egypt found that over most of the country about half of the rural people are infected although this I reportion varies in different villages going as high as 90 per cent in some instance. However in certain districts especially to the north of the delta le s than 20 per cent are infected

In connection with the epidemiology of the disease in Egypt the intensity of infec tion by egg counts as compared with the percentage prevalence is everywhere very

low as compared with most countries where the prevalence is country high

The acquisition of the infection was markedly associated with field work. The rate of acquisition of hookworm milection was independent of the types of crops grown in various districts or of the different methods of irregation in use. While soil polition was found to be very common throughout and ammediately surrounding Egyptian villages out of hundreds of specimens of soil from the e localities no bookworm larvae were isolated. This failure of development was explained by the excessive dryness of the soils the hard packed nature of the auriace and the fact that most village soi s inhibit the development of larvae even in cultures where the physical factors are he'd near their optimum values. This inhibition was tentatively attributed to the pre ence of excess chlorids or any as ociated factor. Fine clay soils do not commonly serve as good media for developing bookworm larvae. Even with irrigation the moisture contained frequently falls fairly low on the surface and under such conditions the hot sun may kill many larvae

Scott emphasizes that the re is no evidence of any factors tending to maintain the intensity of human infestation in Egypt at the observed low level oth r than the influ ence of the low soil infestation roten ity It appeared that in lands under basin irriga tion much of the bookworm infection was probably acquired ouring the season of rising flood water Defecation in the fields was generally found to be scattered and therefore the risk of acquiring heavy infections at any one time were minimized. It would appear then that in Egypt the chimate the physical and economic conditions of the

even though it be effective. If the infection has not been entirely el minated treat ment may be repeated after one week

Hexplesoremol (1 3 dhydrovy a hexploratol) another antheimmtic recently has been recommended and it is a less tour drug than carbon tetrachlonde. It is a white waxy crystalline substance spanngly soluble in water but exceedingly so in alcohol or vegetable oils. It was introduced as an anthelmanthic by Lamson Ward and Brown. It is now prescribed in hard gelatine capsules or crystods. It is said that the drug has generally about a 75 per cent efficiency for bookworm and that it is non tonc when administered according to the instructions and is a particularly valuable drug for use in patients who are critically ill with the disease or where other drugs are contraindicated since the treatment may be repeated at 3 day, intervals

Lamson recommends assistence upon the following directions: the light evening mail-should consist of not foods only and the following morning the drugs, should be given on an empty stomach. The gelatin covering of the crystoxis should not be broken by the teeth ancer to this may cause intritision from the oil to the bucket or escophaged tissues. To avoid this the crystoxis push be smallowed whole with a plass of water. The dosings for adults and children over 12 years of age to 5 pulls for children of 8 to 13 years of age 4 pulls for 6 to 8 years 5 pulls under 6 years 1 pulls. The fulls contain 0.2 mm (gg 1) each and the indicated number should be talken not de see with the gliss of water. No food of any kind should be talken not de see with the gliss of water. No food of any kind should be talken for the case of the contained the

After 4 or 5 bours following treatm at the patient may do as he desires and pursue

his surial occupations.

A saline purge ghould be given 24 bours after treatment. The patient may can tinue to pass worms for as fong as 10 days or 2 weeks after this sigle dies. If the instructions recarding food are carefully followed one dies in suitally sufficient.

Faust states that in children harboring a thousand or more norms the infection may be reduced below chinical grade in 3 courses of a catment

Treatment of the Anaema —The two factors—(i) chronic loss of blood and (2) deficiency of blood building materials—undoubtedly in time induce a hypoplasia or even an aplasia of the marrow and when this is well established the mere removal of the worms will not cure the anaemia.

For treatment then first remo e the worms and administer large doses of iron linute a well balanced diet containing menal protein lipsoids and viriamins. Let may be included with adva tage As to the iron Terris reduct in Bli uds pulls (ferrous earbonn or iron ammonius citarist) by mouth on intraining cular highest of the containing the containining the containing the containing the containing the containing

Heath (1936) emphas zes the importance also of no mal intestinal absorption for the preve 1 on of a sem a lo chrq ic di rrboe fr in whatever caus tron deficiency 1270 TREATMENT

p 1228) Smillie believes it is safer to give o 5 cc to a child in a tablespoonful of castor

Carbon tetrachloride (CCI4) (tetraform) a drug closely allied to chloroform was first introduced by Hall in 1921 for human use as a vermilinge. It has since been employed for the treatment of handred of thousands of hookworm cases with success. The drug has a high degree of efficiency and is usually well tolerated. Its adminstration 1 contraindicated in cirrhosis of the liver in those with deficiency of blood calcium alcoholism respiratory infections and nephritis. Also it is madusable to give it in the presence of Ascaris unless accompanied by oil of chenonodium may remain and obstruct the intestine The recommended dosage is 30-40 minims (2-2 cc) for adults and 2 minims (0 13 cc) per year of age for children. Thi drug on account of its ready availability cheap price and general efficacy is still being widely employed However it has occasionally caused death. Smille (1930) is among those who have reported deaths following its administration. Other recent deaths have been reported by several other chargians

Tetrachlorethylene (C1Cl4) has been more recently introduced as a specific for hookworm by Hall and Shillinger in 1925. This drug is said to be free from most, if not all of the toxic properties of carbon telm chloride and there are records of its having been used in hundreds of thousands of cases without any more unfavorable effects than shaht nausea and dizziness and a transient burning sensation in the pit of the stomach Lambert in the South Sea Islands has treated over 20 000 cases with no reports of deaths. The recommended dosage is the same as that for carbon tetrachloride a cc for an adult and a minims per year of age for children Faust (1940) states that tetrachlorethylene is prob ably the drug of choice in the average hookworm case either in the hos putal or in the clinic

Hare and Dutta (1939), in a comparative study of oil of chenopodium and tetrachlorethylene as anthelmenthics found that tetrachlorethylene in a dose of 4 cc cured to times higher percentages than did oil of cheno podium of guaranteed BP strength in a dose of 30 minims They regard the former as the better drug for all reasons Oil of chenopodium was given in 40 minim doses to 17 cases. None were cured. In 30 minim doses it was given to 84 48 per cent were cured Tetrachlorethylene 4 cc was given to 87 cases 48 3 per cent were cured

In administering the anthelminthics discussed above purgation of the patient should be obtained the night before preferably by the use of 30 gms of sodium sulphate in 2 half glass of water This purgative is recommended as being less toric than mag nesum sulphate if absorbed by the intestinal wall and in addition dissolves mucus surrounding the heads of the parasites as well as decreases the absorption of carbon tetrachloride. In no ca e should nil for purgation be admini tered In the morning the patient should remain in bed abstain from food and only

coffee tea or water be permitted. The prescribed drug to the amount indicated should then be taken

Oil of chenopodium carbon tetrachloride and tetrachlorethylene may be adminis

tered in gelatin capsules or in a spoon mixed with sugar

Two hours after administration of the drug a saline purgative should be admini tered and food alloved only after the bo els have moved freely The faeces should be examined after 3 days to estimate what percentage of the worms ha e been e pelled It should be noted that while dead hookwarms are apt to be found in the first stool passed the para ites may continue to appear for more than 3 days after treatment Eggs of the parasite may remain in the intestine for at least 4 week after treatment

even though it be effective. If the infection has not be n entirely eliminated treat ment may be repeated after one week

Heaptenormal (1.3 dithydrosy a berylbenzol) another authelmentecently has been recommended and it a less tone duty than carbon letrachloride. It is a white wary crystalline substance spanngly soluble in water but exceedingly so in abcolo or vegetable oils. It was introduced as an antheliminthe by Lamson Ward and Brown. It is now presembed in hard gelatine capsoles or crystods. It is said that the drug has generally about a 75 per cent efficiency for bookworm and that it is non tone when administered according to the instructions and is a particularly valuable drug for use in patients who are critically ill with the disease or where other drugs are contraindicated since the treatment may be repeated at 3 day intervals.

Lammon recommends assistence upon the following directions the light e enting must should consist of oist foods only and the following morning the drug should be no on an empty stomach. The gelatin co enug of the crysto day should not he broken by the teeth in ce this may cause instanton from the oil to the buccal or or orophageal ususer. To a void this the crystodia must be swallowed whole is the glass of water The dosage for adults and children of 8 to its years of age is 3 pills for children of 8 to its years of age is pills for children of 8 to its years of age it gives on the children of 8 to its years of age its pills conduct on year (i gives yeach and the middened dumber should be taken one done with the glass of water. No food of any kind should be taken one done with the glass of water. You food of any kind should be taken one done with the glass of water.

After 4 or 5 hours following tr atment the patient may do as he desires and pursue

his usual occupations

A fail no purge should be g. en. 24 hours after treatment. The patie t m y con tinue to pass worms for as long as so days or 2 neeks after this sin le dose. If the instruct ons regarding food are carefully folloe of one dose is u tull y sufficient.

Faust states that in children harboring a thousa d or more worms the infect in may be reduced below clinical grade in a courses of treatment

Treatment of the Anaemia —The two factors—(1) chrome loss of blood and (2) deficiency of blood building materials—undoubtedly in time induce a hypoplasia or even an aphasa of the marrow and when this I well established the mere removal of the worms will not cure the anaemia

For treatment then first remove the worms and adms size large doses of iron lauver a well be lanced duct containing meat protein lipsoids and vitamins. Lie may be included with advantage As to the iron First reduct in Blaud a plis are loth statisticator. While (1903) and Mehrn y (1902) recommend the calculated for the state of the statisticator. While (1903) and Mehrn y (1902) recommend the calculated for the state of
the prevent on of an emia. In chronic d arrhoes from whalever cause from d ficiency

states develop. Hence such symptoms when present should not be disregarded and additional appropriate treatment given to alleviate them

For the treatment of larva migrans, see p 1520

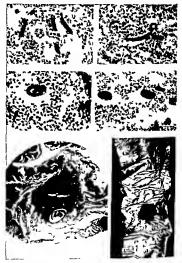


Fig 284 -(After Bonne Courtesy Amer Jour Trop : 1 Med : ne)

Rarer Species of Hookworms in Man

Ancilotisma bra sliense (de l'anna 1910) (A ceplanicum Looss 1911) (Aquinon matodam mifrant Kirby Smith et al 19 6) is a parasite of dogs and cats occurring in North and South America and loss in Cybol India Sam and the Philipputa Human infection has been reported from these countries in association with other species of bookworms. The infective larvae may penetrate the human sim and burrow extensively through the subcutaneous issue causing a painfal itching eruption

known as creeping cruption or laras surgician (common in Florida and other southern states as well as in the other regions mentioned and altrack discussed p. 116, and also in Chap L.) It is the smallest of the species of Anojorisms (the mile not above 8.5 mm in length the formals on min jaid can be discuspinable by the risk of the state of the species of Anojorisms (the mile not above 8.5 mm in length the formals on min jaid can be discuspinable by the risk caused herm which is deeply cleft and each division again bifurcated. Figure 38, illustrates the lenous of the small metations and the invasion of the submuccas by Anojorisms brailiness on a natt e in Java. In this instance reported by Bonne the mussion resulted in pertinents and death. Bonne (4.94) subsequently has described on other cases. In the last of these indections of the intestional wall was observed at sometiments the most common book worm in Java does not show this invasive power.

A cylistome censusus (Ercolam 1859) the dog hook own This species is common in dogs and cats part cultiry in the northern hemisphere. It has been reported once as a par site of man in the Philippone Islands (Vlasslang 1913). The mile has an average length of 19 mm, the female te mm. Rhas a wide buce I capsult is accommodate the 3 pairs of entral texth a daroptite character of the species. The eggs has been used reseminable in the species of the species. The eggs has been used reseminable in the study of the action of hookworm. This parasite has been used reseminable in the study of the action of hookworm.

A cylosioma molaya um is an ursin species which has been found in India and the blalay States and has been reported once from man (Yorke and Maplestone 926) It resembles A duedenole and its eggs are indistinguishable from it. Its chief da tinguishing point is its larger size the males being 12-15 mm and the females 13-19 mm

STFONGYLID AL

Termident demanding (Trade to) from doon star) is a small round worm about the size of a bookerow. The terminal baccal capabil is surrounded by a crown of leadies while at the ha e are 3 forted teeth guard ag the entrance to the enophagus. The vagnal ordice is near the posterior ty. The own stremble bookenorm on abut are larger so by doo more semmented and have broadly round d poles and are somewhat fastened on one sed. The parasite occurs in several moneteys and has been found not uncommonly in man in South Africa (Sandground 103 Blackie 103). Sandground ounder parasite fairs in the United States in the affects of an ensorary from Africa who had been tried for hookenorm i fection previously. The parasite has also been executared in East Africa. In parts of Southern Roberts Sandground found 6; per chakl took in type resembling that of Core-beginesses and is not infective by the skin route. This parasite inhabits the wall of the large board barret in may produce syste nodules. Carbon tetrachloride and tetrachlorethylene have been reported as moderately diffective in evacutating the masture parasite inhabit on the masture parasite inhabit on the street of the st

Oesophaeostomum aprostomun (Willath 1891)-O brumpts -This nematode was first noted by the writer in monkeys (Macacur ph ! pp: enses) in the Philippines in 1000 and also occurs in other species of mo keys in China and in Afric especially ourthern N gena and Central Africa In le gib it resembles roughly a hookworm but a some what smaller In b th se es there is an evend exp usion of the cuticle at the a terior end which is limited in front by a salient oral ring and posterio ly by a construction which is especially marked on the ventral surfa e 2000 distant from the oral estibule this in turn is provided with a crown of az sharp, chitin us plates directed forward and inwards. The male is 8-ro mm in length by 0 35 mm in b eadth the copulatory bursa has a dorsal ray which bifu cates into two branches form g a horse shoe shaped structure each hmb gives off short lateral horn near its base. The female is 10 mm in length by 0 325 mm in breadth. Losterio ly t rmmating in a sharp point the vulva is a tuat d in the anter r half of the body. The e gs are p sed in an advanced stage of development and measure for in length by 40 to breadth and closely resemble those of Ancylost ma The life cycle of this wo mis probably as follows the larvae (filariform stage) are swallowed and pass underested through the stom ch and small intestine and on arrival in the caecum exsheath and invade the wall of the testine where they cause nodule formation The life cycle however has not been completely worked out for this particular species of Oesophagostomum

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The infection has been encountered in human beings particularly in northern Nigeria where it was reported in about 4 per cent of the prisoners in the juils (Leiper) Brumpt also reported a case on the River Omo in Africa

The symptoms are produced by the larval forms becoming engsted in the musculars and submucosa usually in the large intestine. Gradia ally the parasites develop and at the time of maturity the cyst is ruptured and the nematodes escape into the lumen of the intestine. The ruptured cysts are then likely to become invaded by intestinal bacteria which may give rise to inflammatory processes resulting in ulcerations pentionitis and even perforations.





Fig. 285
Fig. 285—Fir idens deminists
Fig. 285—Fir idens deminists
Fig. 285—Fir idens deminists
Fig. 285—Ozeophagostomum Head showing mouth capsule surrounded by a
Fig. 285—Ozeophagostomum Head showing crown with laft is at the entrance

Fig. 255—Ocsophagosiomum Head show ag crown with I all its at the entrance of the mouth capsule. Note bladder like the cken ag of the cuticle around the anten rextremity (After Ra liet and Henry from Mense)

A closely related specie. O stephinostomium (I aillest and Henry 1909) was discovered by J oy in a West Mircan nature. In general character lites it resembles. O appartenium but its measurements for both sexts are nearly double that size. It slop has a corona radicial provided with 38 leadile, spinces (var Thomasu). In the errorated by Thomasu in imazonia in 1910 he stated there was no doubit that the patient died from septic peritorities due to the lesions caused by the nematodes. It has also been found by Joycaux in 1 rench Guinea and by Johnson (1933) in norther in term If the infection is severed the parasites may give rose to dysentine symptoms.

Syrjomus laryaçou (1 ailhet 1800) (S. lengt Leyper 1973) (S. qualiforms of manifest of the syrjomus laryaçou (1 ailhet 1800) (S. lengt Leyper 1973) (S. qualiforms have been reproted the first an Irish voman at Santa Loca (1 ailhet 1814) (S. qualiforms have been reproted the first an Irish voman at Santa Loca (1 ailhet 1814) (S. qualiforms have been reproted the first and Irish to the september of Trivasos (1971) and I ent and Irea (1980) from Bradt 1 from the hippones by St. John (1972) 4 from Trundad and s from Peter 1800 (Ioffman (1972)). All of the enfections were app arently accedental with the parasst S farst transfer of the however approximate the parasstress the upper respiratory tract of cattle structural forms of the however approximate the product of the structural forms of the first traction of the first traction of the first parasstress the recorded as S accepted of which posts are the usual host. Very little is known of the life cycle though Buckley (1934) the levers that an intermediate best as required. The worms in the traches produce

traintive symptoms usually accompanied by bemoptous and at times astima. Discharge of the praisties in the syntum after violent attacks of con king or recovery of the eggs in the sputum provide means of a spaces. Treatment in man has not been studied. Infection is probably acquired through metered uncooked load or by contaminated water. Other species of the genus have also been found in the upper respiratory tract of burst.

Morphology—In the mammalian species the thick walls and buccal cappule is directed anaterial and is a traced in its imme base with 8 subjectual test. If it is provided with a thick muscular sail down to its junction with the escophagis. Immediately around the oral opening there is a the clearchard annulus around which there are a pair of broad dorsal and ventral petal like tips and a pair each of dorsal lateral and sentral list at lips. The male worm is so used ashy analler than the ferm is and is permanently jo ord in opula with her. In the mammalian speci is the eggs are considil and uncapped but in the varian special the gas and provided with polar caps.

TRICHROSTRONGYLIDAD

Track stro goles cel b forms Giles rôgo (Strong-list width 2) is normally a ; ray to disherp and goats. It re-embles the bookworm in its life eyel. Antenority it tapers to a pouncie brased and which is only one tenth the thickness of the pointern extensity. To mouth is un med. If he mate (a mus long) has a prominent equal operate. The quarter of the body. The own (a by yo to one) resembles books one wor but six more training the control of the control

pressal. The infects in occurs by the filteriorm have that develops from the rhabditif m larvae shich hatch from gas no the soot. These enter the body by way of the mouth. The adult price test is even their bead embedded out the intentional misconsa. The small intestine. The diagnosis may be made by it overang the character to eggs in the factors testing the property of the contraction of the property
Here he contrius (Rudolphs 180a)—The sea wery common into tinal parasite of sheep that talest wear leases here been reported or man. He Brazil and 3 in native in Australia. Mal are about two thirds such long (15 mm) and females bout i inchlong (35 mm). The anterior end shows a 10 thick pay the direct did norsd. The studie worms are destinguished by the sight envired hencet (blood hooklet) in the depth of the mail buckel cavity. In abeet plue side of houses are in smallestat on which we had antern a nod smallestation. The own passed in the faces are erv difficult to differentiat from those of other Stronglytae worms and an accurate dig posses can be made; ally atter recovery of the adult worm following an antichmic this treatment or autopy. I said (304) states that are trained treatment of the control of the state of the

METASTRONGLLIDAE

Metast angul s p (Metast angulus to get s Dajardin 1845) (St o gulus p s Gmelin 700)—This nematode is a common paramte of hog occurring in the broin his and causing a brouchtis which may be fatal in y ung animals. It has been reported 3 times in man 1276 NEMATODES

The male is about a meh (25 mm) long with a long spicules. The female is about 2 inches long and has a sharply booked posterior extremity with the vulva just beyond the bend The mouth has a lips each with a lobes. The eggs contain embryos when laid It probably does not require an intermediate host

DIOCTOPHYMOTOEA

Large worms characterized by males having a closed bell-shaped caudal burst with out rays Nouth heragonal with 6 to 18 papillar Oesophagus very long without bulb **Гары**! у рессториумиран

Dioctophyme renale (Fustrongslus ereas) the kidney worm of the dog may rately attack man About a authentic cases have been reported. In many of the reported cases fibrinous clots from the ureters or wandering round worms were mistaken for this parasite. It is usually found in the pelvis of the kidney. One or more of the worms may so distend the kidney as to convert it into a mere shell Pain haematura together with the finding of the eggs in the mone determine the diagnosis. The parasites may produce acute uraemic poisoning. Surgical removal of the norms and appropriate treatment of the damaged kidney are the only known therapeutic procedures. The eggs are 40 by 654 brownish Jellow ellipsoidal with a thick shell marked by pitted depressions except at the poles It is the largest of the parasitic round worms attaining a length of 3 feet and the thickness of a man a finger and has been called the guart The male is about so inches long strangyle

The collar like copulatory bursa of the male distinguishes it from Asserts as does the dark red color Infection is probably acquired by eating raw fish

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Chapter XLV

STRONGYLOIDIASIS

and Minor Helminthic Infections

Infection with Strongiloudes stercoralis of the superfamily Rhobdi souldes. The superfamily is characterized by having two heterogenetic generations one of free living, rhabilitionin males and females and one of parasitic, filariform females. Family Strongvictorious. Genus Strongiloudes grassis, 1807.

Strongyloides stercoralis, Bavay, 1876—This parasite is e pecually common in Cochin China and Brazil, but is widely distributed in tropical and semi tropical regions and is fairly common in the southern Umited States. It is occasionally encountered in temperate regions

History—The raise detected in 1807 and reported in Ballimnes at the John Hopking Victorial Society the first case encountered in North, America Thaper (1921) also reported 3 cases two of which apparently originated in the southern Out of Size. The parasite was first found by Norman (1876) in the faces of French colonal torgo suffering with what was known as Cochin China diarrhoes. Bavay at Norman suggestion undertook a careful study of these cases and named the parisal found in the faces Anguillula storowin: I two of the cases resulted fatally and as actively manuel semalode 3 a species apparently different from those bound doct. The form found in the intestine was named by Bavay Anguillula indicated to distinguish it from the larm found in the stood (Arguillula theorem).

Roux and Laveran discussing the sole played by Angaillula stercoralis in Cochin

China diarrhoea concluded it was probably the cause of the disease. Studies by Ursass (1859) Permonto (1880) and particularly Louckart (1851) domonstrated that the two forms of the parasite named engaliths institution and discressists constituted only different stages in the life of the of a neighbor parasite to red having both a parasite and a free lying generation. Lates it was shown that there were two types of life cycles one with a direct development the other with an indirect heterogenetic on. Lacknessen (1890) layout the view that there were two distinct strains the direct one developing in temperate somes and he indirect one in the tropy. Lividence in favor of this view was brought in 1870 by the writer and by Thayer (1900) and by the writer and by the significant of the strain of the strai

In 1897 in Baltimore and as soon in the Dalapanen, the writer demonstrated by the study of standard actions of the small intertance that the abult parasite females used in the insentinal well—where they gave rise to a catardial inflammation with designant too and in many places acroply of the epitheduc feels and sometimes with an increase of cosmophiles in the insistes. The eggs containing larval forms were laid in the mucrost and when lattled the larval forms passed into the farmeon of the bond. Later vikaning (popo) in the study of fresh specimens confirmed the fact that the adult parasite from its theory of the control will be a support to the control of
In severe infections the lesions of the intestines were regarded by the writer as the cause of the diarrhoeal attacks, partly produced by the mechanical action of the parasites and the products of their metabolism

Following the discovery of the life cycle of the hookworm, Looss (1899-1905), Fulleborn (1914) and others showed that the infective

stage larvae of Strongyloides also might enter the body by way of the skin, passing through the blood stream to the

lungs entering the air sacs ascending the respiratory tract to the epiglottis and then after being swallowed on arriving in the intestinal tract develop into the parasitic generation

In the study of the life history of the parasite outside the 1 stestine 1 e the free living generation of the indirect type both adult males and females were found. How ever up to 032 in the parasitic generation only fem les had been obser ed which led to the generally accepted op nion that the parasit e females were parthenogenetic But in 19 6 Sandground reported the presence of sperma tozon in parasitic females of SI ongyl d s all and suggested that syngamy existed in the genus Strongyloides kreis in 1933 next reported the presence of rhabditoid parasitic males in the faeces of man as well as of a dog experimentally infected with S ster oral's Late these adult males were reported as rare in the intestine but more frequent in the lungs Faust (933) confirmed th discovery of males in experiment lly ufected dogs and has reported upon the de elopment and dufferentiation of the two sexes of the parasitic ge eration from the time they enter the skin or buccs? mucosa until they bec me mature in the intestinal tr ct Blacklock rogs points out that it is very difficult to distingu b the adult para itic male from the free h 1 g male form

Geographical D stribution and Incidence -The pa saite seems primarily adapted to warm chmates but is reported I om t me to time sporadically in temperate o es It is common in the Far Fast as in Cochin Ch na and the Philippines in the Western Hemisphere it has been repo ted as common in Bra il (Sao Paulo Amazonia) in Panama (23 per cent) and Colomb a (16 per cent) and Puerto Rico (35 per cent) Willets found an incidence of 20 per cent in Ge rgia and Wood of sper cent in Missis sippi In other parts f the southe n United State Hinman (938) fo nd it varied fr m less than per cent t approximately 5 per cent Faust (934) in hospit l cases 1 New Orleans found a 4 per cent 1 cidence Hinman also found the incid nce in an institution in Lou sana to be 4 8 per cent while C bl (1036) fou d 7 per cent of infection am ng students in kent cky. It is comm n in tr p cal Afr ca and n regions of the Congo Ostrom repo ted an incidence of 23 pe cent Typic lly 51

the d sease se ms to b more common in the mo t trop calr gions Morphology and Life Cycle -The ttn I frm to merly kn wn as A guill las t tenal a f male long reg rded as parthen genet c lives deep in the mucosa of the jejunum If is about 25 mm long and 40 to 50s Sydney Th yer n Journ 1 wid has a pointed three I pped mouth and a filaniform oesophagus one fourth the length of the b dy The anus

is near the sharp posterio and a d the vulva near the posterio thard of the body. The double uterus occup es the middl and po t nor thirds f the body and cont sa row of

FIG DI d (p tc moth found

d arrho a Rhabdit form I va St gvi de t o al sf m of I'p rame t 1 Med ne)

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8 to 10 large elliptical eggs nearly as wide as the parent worm. The norm is so trans lucent that it is difficult to detect it in the mucosa even with a hand lens. The mucosa should be scraped off and the preparation searched with a 24 inch objective

The ova when discharged from the vulva closely resemble hook worm ova but are strung out in a chain by a thin transparent aheath like membrane and might possibly appear in the facces but this occurs usually only after brisk mirration. Segmentation is well advanced however and normally the osa quickly give rise (in the intestine) to rhabditiform fareae about 250µ long and 13µ broad characterized by a double ceso phageal bulb. They closely resemble the corresponding stage of hookworm larves which may hatch in incubated atools but the depth of the mouth cavity anterior to the pesophagus is only one third the width of the large while in the bookworm live it is about equal to the width. The sudimentary genital organ is conspicuous and shout 204 long while in the hockworm it is small and inconspicuous (Figs 277 and 279) Almost surariably fresh forces contas a largae su strong lord infection by I only out in kook worm infection

The larvae grow rapidly and at suitable temperatures (over re C) may develop in 3 to 5 days anto free laving males and females Both retain the rhabditiform accombagus The male is about 750m long and 40 to com wide and has an incurved tail and two spicules The female is about 1 mm long so to 600 wide with an affecuated fail and a double uterus containing several ova Following copulation (in the faces outside the body) the ova are discharged and quickly give rise to sholdiliform large identical in appear ance with those of the preceding generation batched in the intestine. These develop in 3 or 4 days into floriform larvae about o 6 mm long with a simple tubular occupha gus the infective stage (Indirect or helerogenetic eyele) These are thistinguished from the corresponding stage of hookworm larvae by the length of the oesop hagus which in Strongifolder is one balf instead of only one quarter of the length of the body

If the temperature is below 25 C or as a result of other conditions not yet under stood the rhabdissiorm larvae (assing in the intestine from the paramite female) develop in the facces directly into infective blandorm farvae akipping the sexual stage (Direct cycle) I sust has suggested that larvae from fertilized ova develop indirectly while those from unfertilized females develop directly Others believe that the direct ness or indirectness during the free living phase is contingent solely upon environmental factors optimum conditions producing continuous free living ri abditife in generations

while unfavorable ones shorten free living developmental metamorphous

However Graham (1939) who has been able to develop strains of Strongylo des rolls after exposing experimental rais each to a single infective stage larva has con cluded from his comparison of homogonic and heterogonic lines that the former produces a predominantly direct type and the latter a predominantly indirect type of progeny

It has been claimed recently that under certain conditions some of the rhabitalorm larvae may develop in the intestinal contents into infective filaniform larvae without the usual period of growth outside the body (Hyperi of chie cycle) These are said to penetrate the intestinal wall and immediately go through the usual developmental

cycle superinfecting the best

Faust and deGroat (1940) point out that Grassi and Segre and Leichtenstern found it necessary to postulate self infection (autoinfection) in order to explain the long con tinued presence of Strong loides in human cases. Later Fulleborn was unable to produce internal auto infection in experimental mammals and sponsored the theory of pen anal self infection Fulleborn was convinced that sorting of the pen anal skin with the infected patient's moist faeces containing rhabdituid larvae provided the opportunity for them to metamorphose into the filariform stage and enter the body percutaneously Therefore a number of helminthologists have regarded internal auto infection with considerable acepticism. However several Japanese investigators and Faust and bis associates have reported that they have been able to accomplish experimental auto infection. It seems possible that rhabditiform larvae which hatch and remain in the bowel wall for any length of time may be transformed into filanform larvae and that these may cause auto infection

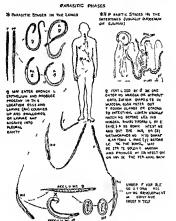
T 28 2

STRONGYLOIDIASIS

In 1936 Nolacco and Africa reported a case of overwhelming internal infection of the body of a patient with filamform larvae of St 1831 det ass ciated with and presumably due to paralytic tleus.

In 1938 Tortes and Azes-to reported autopases upon 2 cases in which they found thabd to d larvae alone migrating I om ulcers of the mucosa of the colon by way of the

THE WHOLE LIFE CYCLE OF STRONGYLOIDES



FREE LIVING PHASES

Fig. 285 - Dagrammatic rp as f t a of th while 1 1 2 of 51 tyle d (Att Faust Rev de p a tol H b na)

substrous lymphatics of the mesocolic lymphatics to the colic veins and thence to the 1 ver and lungs. They believe that this indicated a direct developmental cycle of internal auto infection or hyper infects a

Finally Faust and deGroat (1940) in a study of a case of infection in a male child found in a microscopic study of some of the tissues from the

intestinal wall mesenteric lymph nodes and liver taken at autops) various stages of development and invasion by the parasite. It therefore seemed obvious that self infection in strongy loidiasis may result both from perianal infection of the skin and from the penetration of larvae directly through the honel wall

Infection of man may take place by direct ingestion of the larvae which then penetrate the mucous membranes or the larvae may penetrate directly through the skin. They then pass through the blood stream to the lungs where they remain for some days, developing according to Faust into adolescent males and females Here they cause more or less acute inflammation as do Assaris far ae Filantoem farage have sarely been found in the soutum

According to Faust insermination occurs chiefly in the lungs Some worms start reproduction in the lungs. Nost of the parasites pass by way of the traches and the ocsophagus into the intestine where the female bores into the mucosa and begins to deposit ova about two weeks after penetration of the skin. The parasitic males which are only 0 5 to 0 8 mm long and resemble the free hving males do not penetrate the mucosa and are quickly chiminated. After the supply of spermatozoa is exhausted the female continues for a time to form our parthenogenetically

If the penneum is left soiled with infected faeces development may take place in site and the filanform larvae penetrate the skin superinfecting the host. They may produce local stehing urticarial lesions a manufestation of hypersensitiveness to strongyfold protein Fulleborn has shown that local ellergic reactions may be obtained by cuta neous application of extracts of dired larvae

Epidemiology -In the analysis of \$5 cases of Steongyloides infection in Louisians Hamman found a marked preponderance in malea 30 to 26 According to age the highest incidence occurred in the 13-10 year grown. Although 47 per cent were under o years old the third and fourth decades showed a considerable number of creek the control of the cont Faust (1931) found the highest incidence in Panama in the 11-15 year group after which

it remained generally constant

An analysis of occupation has shown that in Louisiana about one third are school children and almost half were farmers housewives or common laborers the groups which might be espected to be esposed to infection most frequently. Also in Louisiana the disease was more common in whites than in the colored race Fulleborn has abo pointed out that clinical symptoms are much more rarely present in negroes and other natives than in white people

Experimental infection with Strongyloides as noted can occur either through the oral or intestinal mucosa but it is usually regarded that in nature soil contamination of the skin is the usual route of infection. However it seems evident that contaminated food

or water may occasionally be a factor (DeLangen 1936 Blacklock 1938)

The free hving generation shows comparatively little resistance in the soil and the worms are unable to survive for any length of time in water. Nevertheless the litt hving stages have been behaved generally to serve as an adaptation for the preservation of the species Beach (1935) has shown that on suitable culture medium the free living cycle may be carried on through possibly 3 generations experimentally Whether or not such multiplication occurs under natural conditions remains to be determined Dogs have been found naturally infected with a species of Strong loides morphologically and physiologically indistinguishable from that which occurs in man Galliard (1949) in Tonkin has found that young dogs are easily infected with the human Strongslandes In heavy infections larvae are found in the stools on the seventh day The annual always dies on the tenth or twelfth day Monkeys may also be experimentally infected with the human parasite. The infective stage larvae of these animals like the human species are developed in the soil from which man may become infected through skin contact as in hookwarm infection

Brumpt (1936) has shown by experimental infection on himself that Strong loides utille (a species found in the call) and S rath of rodents while not capable of parasitizing man yet when the larvae are placed upon the skin they give rise to a violent pruntis with local urticaria a papular eruption and oedema which may last for a month

PATHOLOGY

After arrival in the intestine the young females of the parasitic gener ation rapidly mature and infect the tissues of the mucosa. The nortions of the intestine most commonly parasitized are the duodenum and upper jejunum However all portions of the intestine have been found infected from the pylorus of the stomach to the anus. Only adult females have been found penetrating the mucosa They penetrate all layers of it and have occasionally been reported as migrating below the muscularis mucosae Whether the penetration into the muscularis mucosae occurs antemortem in human beings is questioned. The ova are found especially towards the base of the will or between the glands where they are found single or in nests. Upon hatching the young farvae pass towards the lumen of the intestine. The writer has in some instances demonstrated them in sections beneath the epithelium of the villi. A microscopical study of sections of the small intestine invaded by the parasites often shows a catarrhal inflammation with desquamation and in many places atroph) of the epithebal cells Solitary folicies are often slightly swollen and there are infiltrations of small round cells about the glands

There may be in very severe infections an increase in the equipophiles about the areas which contain the parasites or ova Howe e it a so not always demonstrable In the crypts of Lieberkuhn containing eggs and embryos at the bottom the epithel um is much compressed and often atroph ed. The epithebal cells are also compressed and atrophied in the cysts containing several ova In sections where the egg has hatched and the embryo escaped the epithelium on one side of the crypt has sometimes dis appeared. There are frequently infiltrations of small round cells about the adult parasites and desquamation of epithelium is often marked about them. Not infrequently the embryos may be seen breaking through the crypts and lying between the epithehum of the sillus (Strong 1900)

Faust (1031) has desc shed the lessons which occur in the skin and the lunes in as experimentally infected d go. He found petechnal bacono charges at the site of skin pen tration of the larvae and intense prunitis accompanied their penetration Inf ctive for as sometimes emain passively in the skin f s several days. Brumpt (1936) and thuman each in experimental cutameous infect as of themselves the former with S 1 I of cal es S 14 of rodents and the latter with S see o ? hav sperienced this prungmous dermatities. However thin lesions appear to reflect a personal idiosynerasy or afferty for Sandground (1918) who acquired a massive laboratory refection with S free of a which endured for me re than 15 years and was accompanied by high easin ph ha (59") and a persistent gastro intestinal flux informs the writer that cutapeous (5 mp never appeared even though he exposed himself on numerous occasions to the infective larvae of S all and S full born of monkeys

When the larvae arme in the pulmonary cavity they penetrate into the alread and bronchigles. This may be accompanied by petechial or even more profuse haemorthage into the air passages. About the larvae there is frequently a proliferation of epithelial cells and leucocy tic infiltra

tion in the air passages. Congestion sometimes apparently prevent the normal migration of the larvae up the bronchioles with the result that metamorphosis into the post filanform pre adolescent and adolescent stages may occur in the lungs. Oviposition may even take place her Bronchial preumonitis may result as a sequel. Adult worms lodged in the bronchial epithelium may give rise to a chronic bronchial disease. The extent of damage due to this pulmonary impartion of the parasites in mais in oil known but in ~ of 85 cases reported by Hinman (1938) a history of antecedent couth and bronchitis was clicked.

Barlow has reported a case with cough for 3 weeks and with signs suggesting a hight bornchial pneumonia while Gage (1901) found the larvae of Strongyloider in the spatum in a case and Delangen (1936) also reported the larvae in the spatum in the cast. It is probable that in man pulmonary lesions and symptoms are produced only by swer and massive infections.

Several Japanese investigators and also Nolesco and Africa (1936) and Torics (1938) in autopay examinations have demonstrated the larvae in the lungs

Symptomatology

In severe infections the females and their larvae which give nise to the connect catarrhal inflammation of the mucosa especially by their mechanical movements and perhaps by the products of their metabolism gradually cause a destruction of the epithelial cells which results in a diarrhoea which however rarely contains red blood cells. The degree of the durithoea seems to depend particularly on the intensity of the infection is duration and the susceptibility of the boxs. In the Far East darrhoea is frequently the most common symptom. Sometimes it alternates with period of constipation. Barlow (1923) found in cases in the tropics that an uncontrolled watery durrhoea with profound emacation was the most conspicuous accompaniment of the infection. However, it should be emphasized that diarrhoea is not always present. Lenn (1938) in the report of 29 cases noted diarrhoea in 5 mucus and blood in the stools in 5 indigestion in 10 and abdominal pain in 13.

Hinman (1938) who studied 85 cases found that 26 of the patients durrhoea, of which 24 bad bloody duarrhoea during the course of the infection? more had alternating duarrhoea and constipation and 10 had constipation alone 26 had lost weight and in the cases where the loss was known it was found to average 12 § 18 per patient.

known it was found to average 14 5 lbs per patien

He found that abdommal pum was the chief complaint and more than one half the patients were disturbed by it. The pam was variable both in character and location in 10 d44 it was distuse and crampy. In 31 it was found to be in the opposition In 7 it was located in the right lower quadrant and 5 in the right sade of the abdome Loss of weight comiting malaines fewer weakness and indigestions were less frequently complained of Tive of the patients were admitted with a tentative diagnosis of appendicuts. The h ghest temperature was not 0? or less in 90 st 85 cases In 14 it was between 100 and 100 F and in 61 two above 100.

Blood—Himman found that a moderate secondary anaemia was frequently present.

Blood —Himman found that a moderate secondary anaemia was frequency picture.

In only 6 cases was the white cell count above 10 000 per cubre milimeter and only 1 below 5 000. The differential count showed an average cosmophita of 86 with 14 cases above 10 per cent. Levin (1938) in the report of 29 cases found an increase

as connophales in 11 Obber audhors have called attention to the marked piper estimaphila which may occur as nevera Strongsidued infection (Reimen (1923) reported as high as \$1.0 per cent wo not have been as well-train has found counts, varying from 15-00 per cent. Nevertheless estimated as at a strainle in human Strongfoods infection and in some dasse the connephila are not increased. Fixed (1925) reported that in human cases the hood preferred to the proper as marked examples in a that in human cases the blood preferred to produce there is no marked examples in a stable interval. The product of the strain of the strain of the strain of the strain as the interval becomes more chronic the cosmophila decreases had a feel open as

Unim (1930) in a study of gastric analyses in to cases found showing achierbydra. Himman (33) lound of 13 patients in which a gastric analysis was performed that a showed hypotherbydra, and a achierbydra.

Youars (1923) has reported one case of harmatura in a woman the larvae were very numerous in the prime

Progvosts

The prognoss is usually good in uncomplicated cases. Recently several very severe cases of unfection have been reported. Thus Moisson several very severe cases of unfection have been reported. Thus Moisson and Africa have reported paralytic items as a result of massive invasion of the board will hy finations have as of Storogicaled setercents. Torrest and A seved of (1938) have described massive invasion of the will of the misso-colon below the musculars incusses by thabditional hirther of Storogy louter. In the alveol, of the lungs inhabdition larvae were found in areas of hamorrhage and pulmorary oederna.

Faust and D Great (1920) have reported a generalized micration of flavorum turner through the bowed wall intenderey rown and have of a whole told who if all of the solid class. The solid class of the solid class of th

Duchosts

The diagnoss is usually readily established by the finding of the motile rhabition larvae in the fresh stools. U wally they may be found in unconcentrated films of the faces. However, sometimes it may prove desirable to centrings the specimen. If the stools have stood for some time before extiningstom it should be recalled that bookworm out may have given rise to the motile larvae. In rare instances, particularly after purpuring own of Stronglisheds may appear in the stools.

Silva (1938) believes examination of material aspirated from the duodenum is more aluable for diagnosis than examination of the facces

In severe infections with pulmonary symptoms the rhabditoid larvae may be encountered in the spotion and faust states that in cases with pleural effusion the larvae may be found in the aspirate.

In a 4 rigle case Tornara (2023) reported the presente of larvae in the urine and in 1850 Tenur thought they were present in the blood of h 2 case but these observations have not been confirmed.

TREATMENT

Chopra and Chandler have pointed out the difficulties in the treatment Since the parasites penetrate inside the mucous membrane a satisfactory drug would have to be fairly absorbable

They found that oil of chenopodium has practically no favorable effect and that the parasites persist even after many courses of treatment Carbon tetrachloride likewise has little or no favorable action. DeLangen (1936) has employed gentian violet by mouth combined with intravenous use of tarrar emetic. Taust (1940) recommends medicinal gentian violet. He suggests for the average case the dye be administered before meals in enteric coated tablets a grain (o of gm) a times daily until so grains (3 3 gms) have been taken The dosage is the same for children as for adults For refractory cases 25 cc of a 1 per cent aqueous solution of the dye may be intubated into the duodenum with good results. In human cases of strongyloidiasis the success of treatment with enteric coated tablets or by intubation of the solution has been attested by many physicians in the United States and in tropical America by Ceballos Carrion (1934) and Kouri Sellel and kevera (1936) For pulmonary mitt tion and for severe late stage intestinal cases he advises the dye should be introduced intravenously in o 5 per cent aqueous solution in amounts not in excess of at to on alternate days for a period not in excess of to days Gentian violet is slightly imiating to the intestinal mucosa and has a mild stimulating effect on the heart. For in rave nous use the above instructions must be exactly followed to prevent precipitation of the dye within the blood stream For such therapy the patient mu t be hospitalized and should be given personal supervision during and following the injection

Brown (1934) points out that patients to whom gentian violet is administered abould be watched earefully for any signs of toxicity such as loss of appetite naives

comiting weight loss and the drug temporarily discontinued it they occur. Hinman employed gentian wolet therapy in 46 of his 85 cases. Anno of the patient were subsequently readmitted to the hospital for treatment and there was no mortally in the series but subsequent stool examination to check the value of the treatment was not made in a large number of cases.

Simpson (1939) has suggested compound solution of iodine (USP) introduced into duodenum through a transduodenal tube. The dose finally fared was 60 minima (4 ee) given on alternate days until neither the duodenal contents or factes shored.

(4 ec.) given on alternate days until neither the duodenal contents of a cover or parasites. He reports o cases successfully treated by this method

PREVENTION

The prevention should consist in measures which are known to be of value against hook worm disease, especially the proper disinfection and disposal of facers the wearing of sboes, and avoiding contact with soli which may be contaminated. At our should be borne in mind that infection might occur from drinking water in marshy districts and from uncooked vegetribles fertilized by infected excrement. Strongyloid larvat have been found on the leaves of vegetables as well as in contaminated drinking water.

RARE OR SPURIOUS NEMATODAL INFECTIONS

Capillans hepatica Bancroft 1893 Mepatical hepatica Bancroft 1891 of and other Trichurdate is Capillans a very common parasite of the two drats and other reducts and the Ausmannes and some monkeys less commonly the dos. The eggs resemble those of Trichurs but have an outer shell a pitted surface and message; at capillans to the state of the

hes to food or by the esting of the infected liver. Only one wind human case ha been report of from a British solle for in India his some as cases of temporary or prends on infection have been published in which the one were presumably eaten with livers of infected animals in Panama Terech casinas Southern Ribofesta and Russia (Frain (1931) O.c.d. (1932) Sandground (1931) Fouter and Johns in (1932) refer to the probable origin of the cases in man in Panama Tere Joand the white I prod pecters? Tayrium peers spreade is the eed by dee monkey Adverse profession and the white faced mankey (As is a few as it is not a few and a few animals On feeding bode) indected livers to other healthy monaeys Foster fourd infection resulted.

Theorem and the family Turbo ophishdre usually found in the tracker longs and mast leavy of crams room anomals feat of one volve force are in Europe and the United Suits; it as been reported by Sherism (app). The aethor reports at occurrence as a featuritative parasite as a patient in Mescow on a beopular allefting from severe trackers bronchist. The eggs of the nematode were found in frieldly rejected rated patients and several to a state of the found of the several contractions.

i sel i rea

Other Spurious Enfections—"speces of Verm thicks (the so-called aching, snakes) have been reported in man in a few unst need but they produce no verytoms and lence see of no clinical importance. Reports of a copreph our menistode. Adhedis is demon a contamination, that solved sitter delections have a muture been made. Thus Sandground reported that a lie proportion of human Noraspinotis is a violection when the contamination of the solved in the s

Chandler 1930-1940, has found \$\tilde{O}\$ steps \$r\$ o ones in the aspirated stomach contents of opat ents in \$\tilde{V}\$ as a which there was almost complete lack of in drochlore coid. This parasite has previously been known only as an inhabition of soil or senage bots. A tested society is parasite on it ing roots of plants. These norms also had

b en previously incorrectly diagnosed as St. 1 est stes

The vinegar sel. Turba is act; has been found on several oc aums in the unne or in visital studiets of women who had accidentally introdu ed the paramets into the vegina in tune vinegar a a visinal douche

A few unstances of infection of man with a material parasites of plants have been readed to on a season Anguillating juriefs are a common parasite of onco. While was been received in the wombine of a process to bad earth unnoted outnot be a process. It has been to be a plant and what they are a manuel by man fee a and tarties have at times table plants and what they are a manuel by man fee a and tarties have at times table plants and what they are a manuel by man fee a and tarties have at times table plants are the factor. Moreous and the man fee and the factor is the factor of the f

OTHER HELMINTHE INVECTIONS

SPIRT/RODOEA

Members of this superfamily was be plump: a sembling A raw; or long and fillown issembling Fid as Lips when preport a pound sumple a thickness techniques bear cavity. Ocsophagia, practi alla alwaya di vided tandem. Vulva more equatorial Fam by of interest Sevantiane.

Spieuridae

Physiologic custom—Physiologic is an a Clinston speel Syn P morden Leiper 1907 is cornally a paramete of monkeys and has been reported in man in eastern and

northern Africa, where it is said to be fairly common. It was first described from the ileum of a patient in the Caucasus and was lifer found in a number of cases in astress. Africa by Leiper and Turner. Backey (1927) reported one human case from such Rhodesa. Taust and Martinez (1925) found the cggs of a species of Physiologies in the case of a number of the control of the tit was a case of spurpous prinsition.

The mouth is provided with 2 large equal laterally placed lips eich having a papillae and armed with teeth. The male (15-50 mm by about a 5 mm) has a fine abapted posterior extremity with 2 unequal succlus. The female (24-50 by about 2 mm) has a pointed tail and in vulta opening in the anterior part of the body. The ova (15-42ab) have it thick amounts should be about the composition of the contraction of the

The parasies live in the intestinal tract with their heads buried in the mucosa of the stomach or intestine. Turner found the liver was also sometimes parasitized

Chandler (1940) states that it is undoubtedly a pathogenic parasite. He has sees see irritation and crossion of the stimated wall of eats infected with a related species in India and has also seen badly irritated stimachs in possiums which are almost always in India and has also seen badly irritated stimachs in opossiums which are almost always in India and has also seen badly irritated stimachs in opossiums which are almost always in the parasite of the seen badly irritated stimates.

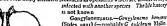




Fig 289 —Phys lopic a mordens Mouth parts shows g the two fateral lips each with papillae and to th (After Leiper)

is not known Gongylonemasis,—Gongylonema konnus Gongylonemasis,—Gongylonema konnus (Stiles 1911) (—probably G pitcharam Malin 1837) na thread like worn muchika shipra o 5 mm in dianneter and from 3-15 m loop froe cutcle of the oseophageal none is provided with 8 rows of shield like cleritions quite distinct from the bosses of Los Termiles have caudid sike and unequal spicual. The vulna is somewhat prenatal Infection is acquired by accidentally swallowing cock roaches, critical bugs or vanous beetles the

intermediate hosts. The parestic normally occurs in rodents cattle sherp and goal monkeys hears and pags. At heary cases of human infection, have been recorded (tist') southern United States and Russia) the worms lwong in the huccal mucuus membranets in which they migrate actively. Six of the human cases have been reported from United States. Ward i Stiles 3 Ransom is and Waite i. One case has been reported from Russia (Schultz).

In animal bosts the parasites are found in long raised channels in the amound and by the composition of the composition of the composition of the composition of the parasites where the past is the word of paties and angle of the past pasts been the locations where the past is the word found. In most of the cases they could be no tryed magnating back and forth in the submucous Only local irritation and nervousness were noted as symptosic except in one instance where pharyngitis and stomathis may have been produced by the parasites?

A related species (Gongylone in neoplasticum) has been shown by Fibiger and subsequently by inhers to produce gastine cartinoma in rats. He fed rats with oct-traction of the species Perifacated americans which harbored the encysted larvel form of Gonglonema neoplasticum and gastine carcinoma resulted. For these investigations he was awarded the Nobel price in medicine

There has been no evidence of the formation of any neoplasm by the species Gongy lonema homins: which resembles in closely Gongylonema neoplasticum and Gongylonema pulchum

Gnathostomatidae

Goathostomass —A number of human cases manly due to Continuous spins grown have been reported chalfy from Sum. Other sufections have been reported from the Malay States China. Japan Inaba and from morth Queenhand. As teals Maplestone and Sundar Face (1930) have reported the finding, of a second Goathorimon in a patient in India from whom rn years ago the first parasite was removed. They thusk that the second worm had survived the whole period This species was firs found by them in gastise tumors of a t er. It is normally parasite in the stomach wall of wild and domestic cats mark and rarely dogs forming hard cystic turnors sometimes 1-3 cm in diameter and causing grave disturbant es. They may open into the additional cavity and may ause fatal personnts.

The pa series vary in length the makes it—a, mm and a mm an diameter the females 37-34 mm. The explaint end is expanded into a globurar seedling armed with 8 rons of tourn lik books. The eg a (in facecal have a play at one end like a bottle stopp cand a cant segmented when deposited. The few develop into larvae in a specie of cyclops. The prast is a not well adapted to man as a bost. No human cases in which the parasites are prast in tumors of the anter timal tract has been observed in the present of 1999 likes or a decidirent flower than 1990 and the timal tract has been observed in the present of 1999 likes or which presents of 1990 and 1990 are found with a or 8 cephalic mars of square which presumably had 3 lott them as found with a or 8 cephalic mars of square which presumably had.

The parasy is have be a found in absenced pocke s or indivated nodules with accross in the int I harder case they have been found in diece putations or subcultacions cannot in which the works were magnified as in larva magnam and personang the condition which has been termed everging trap on Geo Chep. put of the condition which is the condition of the condition of Geo Chep. In Geo Chep. put of the condition of the condition of cosmophiles planta cells neutro pulses and mon at least cells. The nodules have been observed in many parts of the body. Less sen found them in brass aboves se Maglestone found the parasite in an abores selected in child thomas and more farger and in another case on the surface of the temporal must have present with a property and in another case on the surface. If the temporal must have placed with a property of the condition of the property of the point of the description of the property of the parasited in a part of the condition of the property of the parasited in the first property of the parasited in the parasited in the first property of the parasited in the parasited in the first property of the parasited in the par

cease on the removal of a single para we
The diagnosis can be made only aft r worms have been discovered and recognized.
The magnitude younely of the indecision may concludes be confused with other forms fluvinculum; such may be caused by sections. In the magnitude forms, the diagnos a way be confused with fair with many caused by bood-worm.

The treatment about consist of incision of the les ons and removal of the warms

with disinfection of the cavity.

Chandler food that encysted gracipstome larvae—by hart infective for eats are orminon in scales in soun-eastern data and they probably occur in other anima's it is believed that human infection might be cause; by cacting to inside a practice and direct in two men will tainbe so this region. Chandler however was unable to see how cats and studies in marker to most about the direct animal to the feet of the categories.

nature

Later I was shown that the own becomes embryonated and batches in water and detections in C. for Africe, et al. to ever have others that the encyted Larve set [und in fre h water h bean that Philippines and that inf ction occurs not by drinking att containing the inferted sycogo both by estimp and fee h are if it is infer a white the later. It is pressured that the fifth may become unfected from ting sting; I feeted to the containing th

Thela sa

The laises we Think is call paid (the Omental eye norm) Rallect and Reny inco a 17 californ nix Model and Walliams on 3. There is first practice are prihaps more nearly related to the Fig. and at than to the Sy mode. They inched the conjunctives have all in much duties excess on all in man and more commonly in dogs. We times they error over the eye-hall later a turner, to the inner corner of the pyr Fe former spore than been found in lake Burna under Chain while the latter sha only be n 1 und 1 Cd forms in one lumin subjet and also us dogs and cats in the same area. Otter precedent in the same area. Otter precedent in the same area.

The female parasites measure from 7 19 mm long. The males are somewhat smaller. The cuticle is pleated with well defined strictions with sharp edges. There

are no logs, but there as abort vestibule. The vulcas analicros asys Is acknown and to make has no caudal also. The life cycle is not yet known but reach is have been dear to seric as intermediate hosts for T manyon in checkens. On ingestion of the cock roads by the checken the encapsulated harse are set free and are presumed to inspire up the oesophases plant, as and laternal date and orme to reside in the capitud offere. In man the movements of the parasite in the eye cause considerable syntation sometimes neverloss symptoms and eversive homeston.

Faust (1940) observed that the movements of the parasites across the comes with their cuticular string produces at times minute scratching of the surface and that such chronic irritation may result in the development of opacities of the soured are: The

movements of the parasites in the sac may produce exeruciating pain

Trimble attributed parabases of the muscles of the lower eye lid with ectropion to the presence of the parasites. Blandness is not infrequently produced by one species, in cattle in threa.

The presence of creamy white thread worm ma es coiled in the conjunt tivel succe impraising over the cornea are suggestive of the diagnosis. The worms are usually easily removed with forceps but several examinations may be necessary in order to remove all of them

Chellosprima sp Africa and Gateta (1936) have found a parasite of this genus in a nodule in the conjunctiva of a Philippino The infection is unusual, for previous species of this genus normally hive in the lung or in the gizzards of hirds

The Gordiacea or Hair 11 orms (Hair Snakes)

These norms have a somewhat higher organization than the flat worms and are classified in the Annalization of a term meaning thread norms. John measure state they have an atrapheed dag time tract a true body easily gonade discontinuous will other ducte and lack lateral lines and time cells. The addition owns are free living in water. The larvae are parasites in innects. Human injection is accidental. Tan addition are being an addition are longiated vary parasites measuring from roop-one in highly. There after rends are bluntly rounded. The sevently matter worrs mate in water where the exist are laid in stiming. The larvae which hatch from the exp. septential the body will various species of Ord! It ra and other innects. After a metamorphosis they become Cordina blue worms. As they approach measuring they except free living forms. The popular same of hosts but snakes comes from the popular idea that they develop from bore has that fall into nater.

On several occasions when the a hold worms have been passed from the intestral of track of a range or have be a vocated Faugt 1930 states it is believed that either free hings of this or adolescent norms still within the in a cet hosts were accidentally

swallowed in drinking water

In ear ier years grave consequences were attributed to the presence of these parain the body. It is no v believed that the symptoms attributed to them in the alimental anal were due either to other can es or were psychological. Ho verer in a case reported by Faust and has a sociates in which a juvenite femile specimen of Ordina was recov red from the lower border of the optiot of a patien in Thoris the sorn as undoubtedly a tissue parasite and had set up considerable reaction in the surrounds it issues.

The Acanthocephala or Thorny headed Ivenuatodes

There are called though beaded worms because they posses a probosors which projects anternolly like a lattle grean dare around with sweezel owes of hooks which set directed backward and enable the parisate to strach it eff to the intestinal wall. The owners abusely normisment through the general body wall there been no absentially cand or mouth. They are probably more nearly tested to the Cettod than the beautiful of the project of the control of the project of the project of the control of the following species are known to be recorded for man.

Macracanthorhynchus he admaces s Giga torhwachus segus) is normalle an erte tinal parasite of hogs. The male s 2-4 inches long (5-20 cm) the female 10-18 inches

(1sr-15; cm.) The body shows trans ress tings and rescribles As a z but is more white on color. The egge, which are between to color and about Pos-100a long contain embry on with z pairs of large books at the antenor end and a sp my body. The intermediate boits are larvate of June bogs and related bettles and various species of white gubs

Higher indication was formerly can dered to be common as worth Russa (Lambl 18,9 and Lindonann 1860). Lindonann stated that at that time the indication was common in the beings valley where Schne let found the beetle Medanish was eather new More recently Russan arteristication have found pay indicated but no further human cases. In pags as a result of multiple indication cross details inflammation is forceastly found at the site of the attackness of the parasits to the meteritarial will and

n t inf equently perforation of the intestine has occurred

Monally mainered from 1 Becaser 1812 (6) gast dynamics on hife mai) an utes unal parasited frait has been temported in train as a few cases. Human cases of infection apparently authentic have been reposted from Italy the Sudan and British Honduras. Calculate himself experimentally with this parasite. Beran sing on the 16th day after infection he experienced serious guitto intestical pain dust ribose exhau ton somnofence and financias autum. The particles havever did not with applicate himself and the state of the state of the symptoms completely datappeared date; at hours.

The parasite might be contracted by eating death natch beetles as is sometimes d ne with the id a of improving the emplecion. The male is a inches (5 cm) lang the female 4 in inches (10-25 cm). The probatis has 19-15 rows of hooks. A bettle Blajs me nala and the cockeage P planta are come are the intermed at

hosts

ANNELIDA

Leeches belong to the most highly organized group of worms the Anaelists of the class Hirrudenea. Members of this class are parameter or seemiparastic and do not possess chaetae but move about by means of a sucker at the posterior end. They are to a considerable degree sanguin invorous and have a mechanism adapted for the engorgement of relatively large amounts of blood.

They have a rather oval body marked by numerous rangs and well developed muscoid reystem which and I s then sath in yto contents and extend In Addition to the suck at the posterior end there is a sucket at the anterior extremity. Within this is then ut the leading to the plangives which by the action of its muscular valls serves as the must be leading to the plangives which by the action of its muscular valls serves as found which prevents C agulation of the Blood. The mostic hinty or may not be p. a vided with octuing past. In It of there are a famourcated past is exched surfaces of which as beset with from 50 to only the term of the mark of a leech but is to anged r. When a leech base po editable a becomes excluded from the skin of at a vett anged r. When a leech base po editable a becomes decretched from the skin of at a vett and the contract of the state of that the wound continuously server on an erasting coupulation is of some distriction to that the wound continuously server on an erasting coupulation is of some distriction to that the wound continuously server on the state of the state of the state of the boomes infected and believe which may get we serve on other small. This is a particular lay true with He mod p : 2 f mes. This species is a kind letch but requires about data time time. Hence serve may be effected by an area.

Is a rull leeches are bermaghroditic and rep oduce by depositing so-called cocoons which are rounded bodies surrounded by a shell and containing eggs in an albuminous matrix.

While of very I tile medical importance in temperate climates except for the fact that they were employed so extensively in the raperuss for blood? I tring of potients they may be serous posts in many maries of the tropical world.

120 ANNELIDA

Hiri do medicinalis Ismnalis nilolica and Haemadibsa serlanica are the species with

which we are especially concerned

Hirudo medicinalis is the species that has been used medically so extensively in earlier years for the extraction of blood. They have a secretion which prevents coars lation of the blood so that when they are removed the wound still continues to bleed These leeches are about a inches long and of a gravish green color with dingy red long tudinal stripes on the dorsal surface and with a dark green septral surface

Limnates nelotica is an aquatic species found in ponds ditches and other bodies of water in Northern Africa Palestine and adjacent regions. The dorsal surface is greenish brown in color with orange brown borders. The soung leeches which are only about 3 mm long often earn access to the mouth 4 hen contaminated water is drunt. They have also been reported as entence the various and arethra in bathing in inlected water. They attach themselves especially to the mucous membrane of the mouth nose laryny or even trachen remaining there several neeks until they reach adult suc (up to 10 cm long and 1 2 cm wide) They may cause headache and obstinate bleed ing often resulting in severe and even fatal anaemia. In some instances they have caused suffocation both by entering and occluding the air passages. Manson Bahr has reported that they have thus caused suffocation occasionally resulting in death

A closely related species reported from the environs of Sin apore is L marrieds Other related species base been found in Senegal and the Congo ba in Mazzola said he found in one instance an aquatic leech Haemopis confling fixed to the sclero comrai

limbus

Haemadi pra ceylanica a related species is a land leech found in India the Philippures Australia and South America They are only about 1 inch (25 mm , long and are slender. They leave the damp earth to elimb shrubs and from there drop on animals or man passing through the forest. When the leeches are numerous aminas have ometimes been killed by the large amount of blood abstracted and even human beings have been reported to have succumbed from the repeated small bleedings. Their bites are painless but may be followed by ulcers They also may get into the no tris They will even penetrate thick clothing in order to reach the skin

Treatment

When fully engarged the land leech Haemadipsa cestanica drops off. Its removal may be hastened by touching it with a strong cocaine solution which paralyse th leech and it quickly detarbes itself Removal may also be hastened by applying strong vinegar to the bite. The worm should not havily be pulled off lest part of it, as the jams be left in the wound and a phagedaenic lesion develop. If the bleeding continues for some time the flow of blood may be arrested with a stypuc pencil

In marching through jungle land it is very advisable to protect the body from at ack, as leeches can at times penetrate even rather thick clothing Therefore the wearn of

leather boots is advisable Since persons infested internally with Limnatis milotica usually acquire it from dank ing water care should be taken only to drink nater satisfactorily filtered or boiled

The leeches lodged in the masal passages or in the pharynt may be located with a speculum and touched with strong cocsine solution when they promptly detach them selves. If they are situated deeper in the posterior pharynx larynx traches or broach the patient should be placed in the Trendelenburg position before attempting to anats thetize and remove them Otherwise they may be drawn further into the re piratory tract and perhaps cause suffocation Occasionally tracheotomy may be necessar; to remove them If they escape into the oesophagus and pass into the stomach the parasite is rendered barmless by the gastric juice For leach infestation of the genito, urinary tract, irrigations of strong salt solution have proved of value in removing and killing the leeches

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Chapter XLV1

FILARIASIS, ONCHOCERCIASIS AND DRACONTIASIS

Definition —Under the term filaneass there are included mothal condutions produced by certain parasitic nematodes of the superfamily FILARIODEN the adults of which may live in the circulatory or lymphatic systems the connective tissues, or scrous cavities, while certain larval forms, often termed 'microfilana' commonly invade the circulating

blood or the lymph spaces

From a clinical standpoint, the term filariasis is in some respects unsatisfactory. Employed in its broadest sense, it obviously implies infestation of the host with any species of the superfamily and hence widely different pathologic conditions may be included under it Heore special terms that will presently be discussed have been introduced to indicate more clearly a number of the more important pathologic processes produced by the parasites

Classification —The five most important species of the superfamily FILARIOIDEA which infect man are

(1) Il uchereria banerofis (Cobbold 1877) Seurat 1921 Synonym Filaria banerofii Cobbold 1877

(2) Loa loa (Guyot) Castellanı and Chalmers 2913 Synonym Filoria los Guyot 1778 (3) Dipetalonema perstanı (Vanson 1891) Yorke and Maylestone 1916 Synonym

Aconthocheilonema persions Manson 1891
(4) Onchocerca volvulus (Leuckart 1893) Railbet and Henry 1910 Synonym or

variation O caeculiens Brumpt 1010

The gunes aworm Donaculus medinenss (Lionacus 1758) Callandat 1773
Synonym Filans medinensis (Lionacus 1753) while a species of the upperlamby or order Filansiones is no longer classified in the family Filansimac but in that of Dakoukoulinak Leiper 1912 (Philometrida Baylis and Daubney 1926). It is also of special clinical significance and the cause of important diseases in man

Infestation with these respective parasites is discussed under the following terms (1) Filariasis due to II ucherera bantroft: (2) dipetalo nemiasis (3) loiasis (4) onchocerciasis. (6) diracontiasis

More than twenty species of filana have been reported for man. However at present a number of these are not recognized as valid. In addition to the species men tioned above only Mensonella e and (Filana e sand) (Vanson 1897) also known as Filana demanquary on Filana facumana (Righern and Araox 1917). Displana megalhani

and Dioflaria return and Los anguirenda (Vapilestone 1938) are known to infect man Zoology—The adult parasites of the superfamily in order Pirantompa. Wendland 1838 Sithes 1907 are long filliorim nematodes in which the month is usually simple and without lips occasionally bounded by chitmous structures or by small insignificant lateral lips. The buccal cavity or vestibule in absent or very rudimentary. The cospohagus is cylindrical and frequently divided into two parts a muscular anterior and a plandular posterior part. The intestine is simple and sometimes at oppolic posteriorly

Rъ

GENERAL FILARIAL TABLE Larv

Ad h

When bit (Fun ber 11)	Misopyermm P ni gypy a nim Smith ti Bloot t to ty Orany lysopht glddssel	G [lears tail the straght She the Detail of Details She the Details She the Sh	T mass d by m a- que CI Ad A phi C us tph t lymph im byi
Lo I	Mis by some Pennisson St. misson acom Ct. it be cuitd A tenor xt muty ik tru id R d b		Cib will g
Datl w	Mil 4 by 7 mm F mil 15 by men Ct t mooth Ase t mylb hpd Tp ftihw tr slp p T d b t oot f no sety	With chieh a by g or Pit 4% the disperse bit dig Cell c die 2 Dic 2 and di V pot 44 ma the kill 34 m. Pit dight dish	Pth g ty qt d
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O house i i (O ¿)	Mile 183 by \$10mo Final Styfgot 6 d 355 on by 4 w Ctittle f d fdpytikt mdth	With 1 h sh so by 75 F d yetle pice od 1 4 cut tymph p	T mitd by fi it Smim C mill bea t yt t m t rupt y t t t t blad
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Chapter \LVI

FILARIASIS, ONCHOCERCIASIS AND DRACONTIASIS

Definition —Under the term filanasis there are included morbid on ditions produced by certain parasitic nematodes of the superiamly FILARIODEA, the adults of which may live in the circulatory or lymphatic systems the connective tissues or serous cavities while certain larval forms often termed microfilaria commonly invade the circulating blood of the lymph spaces.

From a clinical standpoint the term filariasis is in some respects unsatisfactory. Employed in its broadest sense, it obviously implies infestation of the host with any species of the superfamily and hence widely different pathologic conditions may be included under it. Hence special terms that will presently be discussed have been introduced to indicate more clearly a number of the more important pathologic processes produced by the parasites

Classification —The five most important species of the superfamily Filaziones which infect man are

(1) II uchtereria bancrofti (Cobbold 1877) Seurat 1921 Synonym Filarsa bancrofti Cobbold 1877

(2) Loa loa (Guyot) Castellam and Chalmers 1913 Synonym Filaria loa Guyot

1778
(3) Dipetalonema perstans (Manson 1891) Yorke and Maplestone 1926 Synonym

Aconthochesionema persians Manson 1891
(4) Onchocerca volvalus (Leuckart 1893) Rasiliset and Henry 1010 Synonym or

variation O esecutions Brumpt torq

variation O coccutions Brumpit 1919
The gause worm Diractionculars mediatensis (Linnaeus 1758) Gallandat 1713
Synonym Fideris mediatensis (Linnaeus 1758) while a species of the superlamity of
order Filantione as no longer classified in the family Filantina but in the
Dakcurculmae Leiper 1912 (Philometridae Bayks and Daubory 1926) It is also
of secual clinical syndicance and the cause of monorant disease in man

Infestation with these respective parasites is discussed under the following terms (1) Filarnasis due to Wichereria bancroft (2) dipetalo nemiasis, (3) Ionaiss (4) onchoecrasis (5) directoriasis

More than twenty species of filana have been reported for man However at present a number of these are not recognized as valid. In addition to the species men toned above only Hansonedia or ords; (Hanson Gray) also known as Feleria demarquays or Filana hecumona (Bughen and Arase 1917). Directions magaliset and Directions repent and Low magazineda (Magalestone 1938) are known to infection and Direction as those to not be considered in the constraint of the constraints.

Zoology —The sdult parasites of the superlamby or order Francisco. Weighted (3g Stites 1997) are long fidding mensatodes as which the moth in usually umbed on those the processor of the state of the s

RISTORY 1297

In Dracunculidae there is no insect host the intermediate host in this instance being a crustacean

The family Filaridar has been divided by Yorke and Maplestone into 3 sub families. Of these only 4 the Filaridae (sp. Wuckerera Boncey): D. Magalhaers. De refers) the Loutanz (sp. Las los and Las angiurends) the Oceanocearcidae (sp. Oceanocearcidae) and the Setaridae (sp. D. petislonema perisons and D. o. and), conta perisons and D. o. and), conta perisons of the Setaridae (sp. D. petislonema perisons and D. o. and).

In the subfamily FILARIMAE (Stiles 1907) the species Wichteran bearcofit (Cobbold 1877) is classified. In this subfamily the parasities possess a simple mouth not bounded by chitinous or epaulette like structures and without trident like chitinous structures on each side of the oscophagus. The spicules of the males are unequal and dissimilar The adults are parasities of the connective tissue blood vessels or serous cavities of vertebrates. The larvae produced by the adult para ites are generally found in the circulating blood and are known as microfilariae Infection is transmitted by an insect intermediate bost.

Filariasis Due to Wuchereria Bancrofti (Filaria Bancrofti)

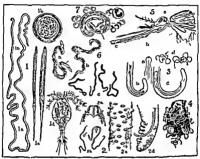
History —The most straining disturbances produced by Hachierus bons jj. such as elephantians of the leg and scrutim were undoubtedly known to the ancient Hindu writers (600 B C) as well as to the Arabian physicians Rha et and Avicenia in the glind and roth century is and were described as elephantians arabicum though these conditions were nometimes confused with the lessons of leptony termed elephantians grace out by Cedius and Gallen Rabelass in this eclebrated D Planchard Partial Fair (11 may with lessons) and flustrates the same in a fancil way within another caracterized of 1555 presented by Blanchard shows onn of the Austrian gene als carrying his secrotit numor upon a wheelthartor who in the early wars of the Pays Ber as reported to have caused the Perch carry to be it a retreat in construction. At the beginning of the spherenth century elephantiass of the scrotim was in in definitely described and if it atted by the surgeon Dion (Oy2 - 7) in a surface of the contracted the form of dephantians; or ceed with lymphantines or channed fever.

However the scientific study of filaransis may be said to have had is inception in 1859, when Demarquay in Paras first demonstrated by incroscopic examination the microfilariae in hydrocele fluid of a patient from Havana In 1869 Whether found them in thylous urine of a Brazilian patient and in 1872 Lewis in Ituda discovered the microfilariae in the perspheral blood of a Hundu. The first adult female vorum five in number were secured from lesions of the arm by Bancroft in Australia in 1876–77. These were studied and described by Cobbol (1877) under the name of Filaria benerofit. However Silva Arajo had previously in 1877 described the genus and named it I inchereix in honor of Wuchterer which has made it necessary to discard zoologically the term Filaria bancroft.

Meanwhile Man on in Amoy China (who together with Lewis had furnished evidence of the ethologic relationship between microfilariae in the blood and urine on the one hand and letphantiasis and lymph scrotum on the other) in 1878-79 made the most striking contribution in

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In the male, the spacules are usually very unequal and dissimilar. The femile is almost always considerably longer than the male and the valve is almost always in the cosphageal region. The eggs are embryomated when land or some hatch within the etens. The adult parasites infiabilit the connective tissue the blood vessels by implactor pressor excities of vertebrates. Bayles and Daubney (1976) recognizes in families in the often while in Jorke and Malpiestone schessification (1936) the order is reduced to merely its families. The Fukusimase and the Dacardon transfer.

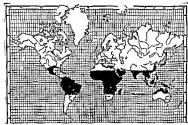


Fits ago—(1a) Adult female Gunes worm (Dresset list and s at 3) show a ganchrong book at posteror exteenily: (1b) Cross section of female D researches showing uterus filled with embryos: (1c) Six ated embryos of the Gunes worm (1c) I/O for a section of the Gunes worm (1c) I/O for a female the mixed cross-team which serves as the intermediate host of D med sens: (2a-rd) Ante for and posteror extr mit es of Los los (2c) Six towning tubercellusted cated (2d) Mal and female Los and traits as (2a) How and troe extremity II cherens beaner fits (3b) Tail of male (3c) Tail of female (3d) Male and finale natural as es of II beavering 4 Tumor mass of quisition open. S Mosqui to showing fairant embryos in thora c mus les (a) and in humo) open. S Mosqui to showing fairant embryos in thora c mus les (a) and in humo) for latella which are exparted from the I bum by Datots a membrat gain and colley of Marcellars of W b scropt in blood. Dott d it as show location in break in cell column and V seot. (Not d swin to scale)

The FILARIDAE possess an important biologic distinction from almost all of the other nematodes in that in all species whose development is known an intermediate he is required for the larval stages and on individual with the disrase cannot infect another. Part of the development of the parasite takes place in some blood sucking insect which transmits the larvae to the fresh host.

In the family DRACUNCULIDAE (Leiper 1912) the females are enorm ously larger than the males and the anus and vulva become atrophied in the gravid female. They are parasites of body tissues of vertebrates

77 were infected with M crofile i a bancroft. He als detected a few cases of the disease else he e in South Carol na and in Jacks muille and Tampa I lorida The latter case h wever had previously lived at some time either 1 Ch ileston or in Cuba Spo dic cases of a fection as pear from t me to time in different parts of the United St te pa ticula ly in the larger citi s the primary infection pr bably having occurred n subt pical or trop cal countries. Poind vter and J nes (1934) have reported a case supp sed to ha on mated a far po th as Wash gion D C It 1 not no end mcany here n the United State



Pic 201 - G n

Etiplogy -The adult p ra to of the sp c es il uchereria b fit are the dike white and tran lucent in appearance ith a smooth cut cul m. Alth. gh taperi g towards both ends their te man is are bluntly to ded. The head a sla hilly built us and a provided with to rows of small sess le p pillae. The mouth a with ut lips and is unarmed. The oesophasus has no distinct bulb like swelling at the posterior extr m ty The males me ure from 40 to 45 mm n length by about o mm in br adth The caudal e t emity a curved sharply ventrad Leiper and Faust has d t ngui hed

twelve pairs of a ssile c udal papillae of which ght o rs are preamal and f ur unmediately posta al n p ton Further caud d there are two pairs of rathe 1 rg ses ile papillae and at the caudal extrem to a 1 t ry nair of mi t e Caulalalaeareoft n d t nct The two opul to y spicules are of un qual length th long one h ng cylindrical and t pe mg to a lo g l h the h ter ne bem Fig 20 -Mal () trough shaped The f m l s m as e from

nd f m 1 (b)

I tu al s 65 to comm in le gth will a hreadth of from

o 4 to 3 mm The ul a sestuated ah ut o 6 mm to t 3 nm from tle cephalic end The uterus which occupies the greater wtent of the body c ntains the ov which measu es ahout 40 m in leneth by 25 m h adth in the ant 110 portion of the ut rus well to med embryos are often contained. The o a are enveloped by a transparent membrane apparently chors n n ong n which grad Ily becomes stretched out and adapts itself to the len th of the embryo as it trai btens itself and which constitutes what I k own as the she th of the mucrofil mae after its ait from the parent worm This sheath is frequently a mewh t long r than the enclos d m crofilars e and the

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connection with the history of the disease demonstrating that the mosquito Culex fatigans, subserves the parasite as an intermediate host

At first Mangon thought that the fully developed microfilance escaped from the body of the infected mosquito anto the water at the time of the death of the insert and that man contracted the infection by disning such water. Later Low in 1899-1000 discovered that the larvae undergo further development and eventually pass into the probosts; and absum of the insect. Grass and Abe soon confirmed these expenients with Disnifiants simular and produced infection in dogs through the bits of other infected mosquitoes. (Inspifiants meanity must). Tullberon Manson Balt and other have likewise proved that the larvae escape by way of the mosquito's proboxis and enter the skin of their definition have

Manson in 1880 also described a remarkable phenomena known as filarnal persoducty relating to the time of the appearance and disappear ance of the microfilariae in the capillanes of the skin and superficial blood vessel. He also proposed to call the larval form of the filaria in order to emphasize its nocturnal periodicity, Filaria noctural of which to the fuller governing zoological nomenclature it became nocessary to discard such earlier appellations though the name of Wirefilaria bancefit is still commonly applied to the larval stage which is encountered in the blood

Geographical Distribution -II uchereria bancrofis has the most exten sive geographical distribution of all the Filamidae and occurs in practically all warm countries It has been found in the western hemisphere from Charleston S C as far south as the Argentine in South America and in the eastern hemisphere from southern Spain particularly Barcelona as far south as Brisbane in Australia It is especially prevalent in India and South China extending as far north as Shantung Province and southern Japan and southwardly to the Dutch East Indies and other islands of the Pacific where in some localities 80 per cent of the inhab stants are known to be infected. Hargrave reported that filariasis in American Samoa probably causes greater damage than any other disease by reason of the disabling effect and the undermining of the general health which may predispose to other infections Phelps in American Samoa reported filariasis as the third cause of death in frequency the first cause being tuberculosis and the second pneumonia A survey of the native guard and civil employees there showed 18 per cent harbor ing microfilariae in the blood However the rate of filariasis frequently varies in adjoining areas in the Pacific islands as has been especially demonstrated by Manson Bahr In the present war numerous cases have occurred among our troops in the Pacific tslands (See page 1, 6)

The infection is also common in Arabia and West and Central Africa. In South America it is common especially along the northern toxis but apparently it has not extended far infand in the Gomans Colombia and Panama with the Mansieria and has recently been found more prevalent. It is common in the greater and learn Antilles. In the United States Charleston was formerly an endering found infection Observations upon the occurrence of the infection at Charleston or Mobile in early years was made by John Cutterns de Saussier Mastin and others and in 1913 Maiss reported upon the occurrence and treatment of elephantians in New Orleans 1915 Johnson Jound that is per creat of the patients admitted to the Roper Hisspital in Charleston harbored Viscofficience in their blood and in 1919 Francis of the United States Public Health Service found among good undividuals lywing in Charleston that

host In infection with Wucherera bancrofts where the insect transmitters are mosquitoes which particularly bite by night as for example Calex fatges, the microflainess are found in much greater abundance in the peripheral circulation at night than in the day

During the vaking hours of the patient it has been assumed that they retire to the hungs kindrys and deep-lying issues. Here is some post marrier evidence to this lungs kindrys and deep-lying issues. Here is some post marrier evidence to this effect and if the blood is examined in the day either no microfilation are found or only one or two in a long search. Toward evening they begin to appear an excludily increasing in numbers until about midright it is not musual to find as many as 500 or even do no never just green poly blood. Masson Balls readingted that in severe infections there may be as many as forty or fully millions a multaneously circulating in the blood vensels. After midright they decrease gradually I. Low and Vlasson Balls required.

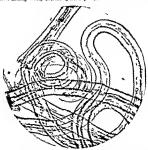


Fig 293-Mil Wacker baser fit P ter nd from lymphateve lafun win (After S ndgr and)

periodicity in sepaticity for as long as twelve years. In Los los infection on the ther hand where the vector in the Chrysoph fly which bites by day, the microfilans are more abundant in the circulating blood dering the daytime than at high! This occurrence originally led the late for Fatrick Manson to ref r to this emitrofilan e as Microfilar of urna and Microfilars nections respectively.

That this phenomenon of pe not city of the filter e is in some way profoundly induced by the is change habits of the diffe first hours has been shown by the fact that in 18 usberreis b in c filter and in the stress been c filter and the stress been c filter and the stress been considered in the stress been become most numerous on the perspectable blood during the daytime. In Les los indictions where the period city is during Los found that this re rail cann the effected as easily and in the case did not section using May Kult however has shown that it may gr dusly take place I in infection with Diplatherma perceive and Onsherrers so fault and occountess where the useful transmitters bit by day no such period city of the microfiltance has be on shower that the office of the microfiltance has been described by the proof of the microfiltance has be on shewered. Also in soons of the situadies

I 300 FILARIASIS

organism is thus able to move back and forth within it. White most rootputs believe that the shorth is a modified within members beginned (1997) from the studyed another species of 1 egrafforms which occurs in ground doves believes that the shorth merely the result of an incomplete eclaysis. In other species of the Idiarable such as Dipidalontma perilars the larvae hatch or encape from their sheaths while still within the uterus of the adult female which is the wiveproops.

Microfilaria —The fully mature female gives birth to an enormous number of the larval forms or microfilariae. These after leaving the parent worm either remain in the lymph or migrate by the lymph vessels to the blood stream. When seen in fresh preparations of the peripheral blood or lymph or in chylous urne, they have a very lively mothity. They measure from 12 to 230 µ in length by 7 to 10 n breadth.

The cuticula is smooth the head is round and at the anterior extremity a protrusible punute refractile rod or stylet can sometimes be seen. On vital staining of in fixed preparations stained with hematoxylin or Gienesa's solution, the sheath as well as the timer structure of the organism can be more clearly differentiated. Four equidistant papillae on the oral end have been noted by Abe The tail is distinctly pointed The body of the larva is composed largely of small subcuticular cells. The central am consists of a enlumn of cells with deeply staining nuclei. Interruptions in the stain ing and the position of these cells are interpreted to indicate the location of certain anlage of the worm They relate particularly to a first break in the column of cells about to per cent of the length of the organism backward from the anterior extremity perhaps indicating the nerve ring to a second heatine V-shaped space about 30 per cent from the anterior end representing the undeveloped excretory pore and adjacent to it an excretory cell and third to a somewhat similar but smaller spot a short distance from the end of the posterior extremity which has been termed the fail snot and which probably represents the incipient anus or cloaca Four genital cells can also frequently be distinguished in the posterior portion of the organism three being situated close together in front of the anal pore and the fourth and largest about 70 per cent of the length of the larva from the anterior extremity. The relative position and distances of these structures or anlage from one another together with the size and relation of length to breadth are somewhat constant for the species and are utilized for the differentiation. Thus in Bucherersa bancrofts the terminal 5 per cent of the larval form is free from the rod like nucler which serves to di tinguish it from the larval forms of Difetolonema and Los in which the nuclei extend further to the tip of the caudal extremity Also what is known as the Innertorper of Fulleborn consisting of a red staining mass in which may be distinguished a series of discrete nuclei on a blue background extending for one tenth the length of the worm distinguish it from Microflares los Fulleborn and Rodenwaldt give the following location of the e structures of value in diagnosis in Microfilures bincrofts nerve ring 20 per cent distance from the anterior extremity excretory pore 29 6 per cent excretory cell 30 6 per cent genital cell No 1, 70 6 per cent anal pore 82 4 per cent genital cells Nos 2 3 and 4 situated

immediately in front of the anal pore

There has been no true cultivation of microfilatiae in vitro though they have sometimes been kept alive for example in defibrinated blood in test tubes for as long as an
weeks but with no definite development.

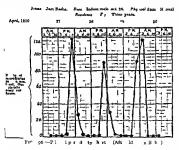
Filanal Peroducity —A striking phenomenon first noted by Manson in 1880 regarding the time of the appearance and disappearance of the merofilaries in the capillaries of the skin and superficial blood vessels is referred to as filanal periodicity. In explanation of this it has been suggested that in some species of Filandae there is more or less definite adaptation between the habits of the microfilariae and those of the insect

Although much work has been done upon the subject both in earlier and in recent years the periodicity of filana has never been sitisfactorily explained. Among many theories the following have been especially advanced in recent years.

1 That it depends in some way on the hours f rest sleep and activity since the periodicity may be reversed by cha gin, the hab ts of the infected individual

2 That it is related to the habits of the muset host of the larvae the insect host that than mits the infection.
3 Clayton Lane especially belt es it depends upon a daily cycl cal parturition.

3 Clayton Lane especially new 6 H depends upon a daily cycled particular of the famile foliant with the daily of struction of all the microfilation are believes all of the microfilation are born at a regular hour e ch day and after a certa minterval track the per phend incrudation. I has recent attacks on the subject to states that the daily of truction of microfil rune is acc mplished by the etical endothabial system.



O Connor demonstrated that is some matances by the ex minition of serial sections of saddifferable woman removed surgically from patients in N w lock City the uterian at a certain period if the day w is completely follow while early to whereas at nother proof the uterin was empty and leadaged O Connor and Hibles (93) the gift with the foundation of the three contrasts in the result of the contrasts of the section of the section of the contrasts of the section of the contrasts of the section of th

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of the Pacific as in 13), the merofilarine are non periodic and are often found in the blood in great a bondance during the day. It was formely suggested that there are periodic filtrate of the Pacific Islands were the progress of a part uson specially distinct from its interferent homestyle but Leap 1 rathed to find any amount different between the I span worm and II homestyle of other regions. Manon Bahr and Full born also tought the merorializing of these different constructs without and Valley and the state of these different constructs without all. Manon Bahr and the state of these different constructs without all.

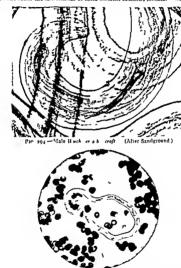
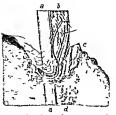


Fig 195 -M crofilaria Wu hereria banerofti in blood

suggests that the non-persodic habit of the Panific merofilmen may be a partial sloplike to the day habit of the sund intermediary of the paratite in I just ad other lactic that the Active merofilm (Siege 1926 pendessatellaris). This observation has been confirmed by O Conner who has observed that in such reg-ons the range of non-provide films is occusived with that of its intermediate host Active surregists in the Pacific ham nompute as is well known. Most frequently during the day meal In the case of Mf bancroft, the embryos after arriving in the stomach of the insect if they are still within the sheath escape from



Pro 97—8 t no? Azd p sd sc s ll how og fil n th n tenth day of d v l pm nt t v ling forw ds nt p obo (Byp m f m M ns n Topesl D eass)



Fc 298—Fin mgng f m the adofam qut pb upnth kn ×250 Sm hmtc (Aftr Fullebon)

the sheath within a few hours after ingestion. Within 24 to 48 hours they have migrated through the gut wall to the thoracic muscles of the

enormous number of microfilariae. There is no scientific evidence yet that such destruction and rebirth occurs

Himman (1933) has demonstrated that in dogs where the question can be studied more securately and extensively cyclical particultion does not occur with Direction immutis. Regardless of the time of day of the examination he adult norms were always found to contain many active microfilarae. He also produces evidence to also that it seems highly improbable that the adult norms produced and the number of the control of the number of the

There is much evidence also to show that microfilance live for considerably longer than twenty four hours in the circulating blood. Rao (1933) has found that microfilance survived in vitro for 4 to 6 weeks under asspite conditions while Hinman (1935) found that microfilance of Divollance amontic maintained their activity in nigulating.

at to C for 10 days in citrated blood

of microfilariae found in the blood

Undersood and Harmood (1933) transfered intravenously an uninfected dog will blood containing approximately 233 000 microfilariae of Diregilaria remaint South blood tromparatively few of the microfilariae appeared in the peripheral circulation following injection. However these survived in the blood stream of this dog for more than 2 years though no interesse in sure of the embryos has noted at say time. At sulceys of the animal about two sind one half years after the injection of microfilariae as embryos could longer be found in the blood.

Rao (1933) reported 2 cases with filanal cysts in which the adult filanae were removed with the cysts by operation in one the microfilanae disappeared completely between the second and third month after the cyst was excised in the other 70 days.

after the removal of the cyst and adults. In these cases there was apparently no sudden

or large daily mortality of the microfinance. Knot this reported a sense of transfusions of human blood containing the microfilariae of il udsterent benergiti into non infected humans. After a number of failing the states one transfusion resulted in wabibity of microfinance for 14 days and to observation of typical nocturnal periodicity of these transfused embryos. This patient had received type of a blood containing 4 one microfilariae per ce a total of sent 700 000 microfilariae. The writer and also Human (1937) thought this evidence very conclusive that the microfilariae berd for at least 14 days. Goment repetited with the microfilariae human for a least 14 days. Goment repetited with the microfilariae human for a least 14 days. Goment tended with the microfilariae human for a least 14 days. Goment tended with the blood in the first fee days some of the off presister persisted for as long at year. The author had never visited any region with endemic filariasis and so the possibility of latent infection could be excluded.

Himman (1937) moreover has continued observations of adult Directions in attuant media in vitro consisting of blood servation of the Albert and Tinger as solution and has found no evidence whatever of cychect partitions but only that there is a more of fess continuous partition being carried on Himman Faust and de Bakey (1934) also transferred infected blood after directed dor.

found in the recipient s blood for a period of over six weeks

Harley (1912) suggested that there was a chemostactic substance in the salva of inacts which produced a stimulus for cycleck parturation. However filmans here in mable to isolate any such substance from several species of mosquitose though O Comor abood Guiz of policy see could aborted many more microfilmate from the blood than Acides serypis. Shalif (1928) believes that the site of the adult filman in the human body may be a determining factor as to whether the microfilman is prior or nonperiodic. However this has not been demonstrated and obviously the mechan is med filman's periodicity is still unsolved.

Transmission—With all the microfilariae an intermediate host is necessary for the further development of the parasite and with the exception of Dracauculus medinensis, the intermediate host is an insect. When the appropriate insect host sucks blood from an infected individual the microfilariae pass into the stomach of the insect together with the blood

- 13 Anopheles hyrranus var senens e Chuna Japan
- 14 Anotheles ludlows var sundace India
- 15 Anobheles (My orhynchus) nigerrimus Travancore
- 16 Anopheles pallidus India
- 17 Anopheles of il pomensus India s 8 4nopheles pseudojamest India
- 10 Anopheles & net lates New Gumen
- 10 Annihiles chodessenses 1 West Africa (Sierra Leone) 1012
- 21 Anobheles (Maomyra) roses (A zuberetus) India 12 Anotheles sougmosus West Africa (Sierra Leone) 012
- 23 Anoth les steckeus: India
- 24 Anopheles amiet es Queensland
- 15 Anopheles varuna India
- to Cilex fotigant (C or no reforciatus) China India Egypt Australia West Indies Antilles Tennidad Philippines Pacific Islands St Lucia and Charleston South Carolina
- 27 Culer outsens (C. tallens) Central China, Japan Erypt (Carro) 1913
- 18 Coler utham India
- 29 Mantonia (Mantonioides) e ei dotitillan Malavsia
- 30 Manionia (Manionioid s) uniformis (seu african is) Central Africa
- 31 Vansonia (Manionioides) annul fera India

32 Montonia (Mantonio des) 2 inta Bruzil Undoubtedly other spec a may be f und t be appropriate h its as othe in est gat on are made. His e er aper m stal demonstrations n the labo at my d not necessarily and cate the tall I the sor cles of mosquities in which the ir see hive com pletely developed c nit tute common interm d'ate hosts. C fut gans C pipirns & or egats and I assi and II a particula ly common t anamitt a ha (1938) r ports that Mr c flor s ba e ft may at de ig ath sandfly Phi b l n : serg ste

(at m ng lens) An ght (044) has summer a dour present knowledg to reg. d to the t an mission th S uth Pacifi and tustralis as f lio a Filo 123 s at pea a t be f the infects p dom nantly nocturnal from South Qu n land through New Cu nes to the 5 lom ms The chief ect of the nocturnal f rm a Aust at is th night and he Hebr de b ting d m st c and d h st ead (i q 1 iq fase ti (Cil fican) In New Gu ea th re und ubt die nother vector for the reg us ut ide th fe area of perms at hit scill m at The anach i nes may will be the most imp tant ecto a in those area for the of les or cital a faubane se not specifed has ben found nat ally niect d this min ben Cu ea by Backh u e and Heydon In add tion Heydon blan dart i at f to a f photo am fo In the Solom as and New Hebrides to dem logical evidence ould ad at the two shele pinel lot is farait (= 4 pm/cre s) sthe ect r

In the F ps and in P lyne to file says is clat ly non per od c with the tendency being t ands a durnal strain. If a the vector is day bling in sou to deder if it i ped i fills s which breed in all the s of a tu al and a tife al ater hold growt such as had eig computed list tree biles to cans rain bar is etc.

PATHOLOGY

In man in tanc s ninh chith piegen e of the adult filter all para les in the body is ogn d by the occurrence of m croffar e a th blood the pa as tes exerc se no gn able njur us pfinene r pathologic changes. On the other hand in m ny c ses g a c l s n ault Som author ties who have a very wide exp ience th tilar ass say th t in m my or in st cases the para te evert ses n man fest input us nfluence whatso (Manson q S) How er O C mor and Hulle (1932) have h in that in a m p no h h ene ere mpl net of somotom and a ru a ar of any of turbance marked s ath 1 me changes associated with filer al infection mile occu har us stage I nil minutory each n and for a were I and by these auth a bo tadelt (la : in th i mphategian is remove i be operation fr mar at ent who had not or kn widge of the is is not a

Und ubtedly in many cases with internaliante in the bl od no manifestation of disease may be nited for long periods as Low has pointed at Honever it a emis pos Allowed complete dev lapment but no record of its infect on in nature

insect where this soon change considerably in form becoming shorter and stouter and more sausage shaped but with a sharp, tail like process

They now have lost greatly their active motility and finally become quiescent. In the further development one or more moults (shedding of cuticle) take place and in the course of a Week considerable changes occur in their internal anatomy the gut rectum anus and body cavity having become differentiated. During the course of another few days the larvae increase considerably in size becoming more slender and elongated and again take on even more active motility Still later they begin to migrate from the thoracic muscles chiefly in the direction of the head though some of them pass into the abdomen particularly in the malpiehan tubes and in the fat body and even into the legs of the insects and undergo development there. Many of them penetrate into the musculae labium of the proboscis. The final infective stage of the filariae measur ing from about r to 2 mm in length and about 204 mide may be found in the proboses usually in from 12 to 24 days after the insect has imbibed infected blood. Depending particularly upon the temperature and moisture or perhaps to some extent upon the species of insect the complete period of development in the insect may take from to days to 6 weeks

When the insect again feeds on human blood, the microfilanae some times several at a time moving downward through the labium break through Dutton's membrane when it is put upon a stretch by the wide separation of the labella at the time of the feeding of the mosquito Arriving on the surface of the skin of the human host at or near the point of puncture, they then penetrate the skin and reach some part of the lymphatic system, where the potential males and females are believed to grow to sexual maturity. The females become fertilized by the males and new generations of microfilariae later reach the blood stream of the Eventually some of the adult parasites give rise to the different pathologic conditions It is not known how long it takes for the larvae to become mature but it is probably many months before the female begins to give birth to microfilariae *

It should be noted that there is no multiplication of the larvae in the The larvae taken in at the time of feeding of the insect merely grow and become transformed into the infective stage in the mosquito

The complete development of the larval forms of Il nehererta bancroft has been observed in the following mosquitoes

tedes acgypt: West Africa New South Wales Dutch Guiana

2 ledes (Finlana) togos Japan

3 1 Iedes variegalus (Sieg myie scut Mares) Samman and Fau Islands

4 Aedes ochracens 1 Nigeria

Anopheles (Aystorhynehus) gibimanus Caribbean

6 Anopheles albitarsus Bizzil

7 Angoli les (Anopheles) algeriensis 3 Tums 8 Inopheles barbirostris India

o inopheles (My omyra) gambrae (1 costales) West Africa

10 Inopheles f liginosus India

11 Anopheles funestus West Africa (Sierra Leone) 1912 12 Anopheles hyrcanus var nigertin us India

One instance reported by f Il Taylor in Aigeria (2030) 1 Reported by error accords ig to Semeset

Some suggest from 9-12 months In some instances sections of the glands have revealed immature parasites in individuals who have resided less than 6 months in the endemic area

† Synony in ledes sculcilaris vat ps i do sculcilaris

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be calcified Inflammation and degenerative changes as well as disturbances of circulation in the lymphatics may be brought about by dead or calcified adult parasites

O Connor (1932) has concluded from his studies that the adult parasites while alive in the tissues give rise to no serious inflammatory or obstructive phenomena nevertheless obliterative endolymphangitis may appear On the death of the parasite however conditions are quite otherwise

Degeneration of the adult parasites may occur in one of three ways. by calcium deposit in the worm by lymph coagulation or by a combination of the two He also thinks that o long as the microfilarine live there is no e idence that they damage the tissues. However dead worms, undergoing disintegration and absorption probably liberate toxic substances which may give rise to acute inflammatory changes. The most marked evidence of acute inflammation in his cases was about worms undergoing degen eration O Connor belie es that the acute inflammatory scaction in filarial lymphan gitts is allergic in character and corresponds to a period when sufficient protein i hberated from recently dead worms to overcome the resistance set up by previous sensi tigation. Such reactions when due to minimum amounts of protein might be subclinical in degree as seen in localized art caria without definite inflammatory attacks transient rises of temperature local ps a without inflammatory phenomena while when large amounts of protein are liberated the typical inflammatory mani jestations of filarians result. Actor and Rao (1030) in support of this allergic hypothe sis have also reported a series of cases with urticaria and cosmophilia believed to he due to the filarial infection

The dead degenerating and the calcified adult parasites in the tissues of the host may go e r e to inflammatory changes even when bacteria are absent. These may he subscute or more chron c eventually bringing about fibrotic changes. However the writer has found particularly in studies in onchocorciasis that the living parasites may also cause suhacute and chronic : flammatory changes To what extent these are due to the movements of the adult parasses and the almost continuous passage of enormous numbers of microfilariae through the tissues im nediately au r unding the adults and to what e t nt they are due to toxing o metabolic products from the parasites is not clear The cosmoph is are frequently though not invariably numerous in the tissues in the v C ity f these paras tes. The living adult it uchereria bancrofts in the lym ph tics of the host may also give rise to proliferation of the endothelial and connective t saue cells resulting eventually in the formation of new tissue and frequently producing chr nic obliggrative lymphangil a nd thicken ng and enlargement of the part (elephan tias) In some instances a lymph th ombosis may form about the parasites. About the adult filars e th t are more o less degenerated infiltration with lymphocytes and plasma cell may be observed to have taken place with later an invasion with fibroblasts and the formation of fibrous t sue sometimes enc psulating the parasites. Foreign body giant cells may also be obser ed. Such changes may lead to complete blocking and fi I obliteration of the original lymphatic vessels. O Connor has also reported that d generating microfilar ac especially in hyd ocele may cause tissue changes such as local areas of necrosis and prohierat on of connect ve tissue about them o c in tance masses of m c ofilaria were found in a polyp like growth of granulation tissue at the reflection of the tunica wag nalis. He has also observed the calcified sheaths of microfilariae in the subcutaneous t saies in elephantiasis of the leg

Lot in f Adult Parus ten—The adults of both s. es often me trabily cold together live in the lymphatic vessel bout the abdomnal cay ty in particular. They may be found in the thorace duct de swawaft the lymphatic of the lower extremine especially in the of the grown. However they may be present in the lymphatic vessels in any p to fit the body. Comm in sites are the elephat of times of the testinal gentals and the maxim my gland the lymphap glands of the extremities abd minal retroperatorial regions about the Longra and the cyndrodymis. In Japanes cases Myake found them pat call by in the inagunal and femous glands and in

sible if a large series of cases were carefully followed up for a period of years that some of them would develop symptoms of some sort and anyone who reveals the presence of injection is potentially habie to attacks of filamal disease. The number and location of the parasites and whether they are abve or dead may also influence the clinical mans festations of the disease In many cases of infestation in which there are no unfavorable symptoms the presence of cosmophilia which may be moderate or pronounced, and is common in certain other belminthie infections demonstrates a prohable toric effect of the parasites It is now well recognized that patients with elephantiasis of filanal ongo may fail to show microfilariae in their blood. Hence the absence of microfilariae in a case of elephantiasis in no way puspifies the opioion that the elephantias s is not flarial in origin. As a result of lymphangitis lymph stasis and blocking of the lymph chan nels the lymphatics draining the affected area may be so effectively obstructed by the parasite or the products of inflammation about it that the microfilariae may be pre vented from reaching the peripheral circulation. Sometimes operation upon an enlarged fibrotic lymphatic gland or a group of such glands may open up new channels of circulation from the mature female and may lead to the appearance of microfilanse in the blood which had not previously been observed there Manson Bahr notes that adult filariae of both sexes in large numbers have been found in enlarged fibrosed lymph glands the epitrochlear for example without the presence of the corresponding micro filarize in the blood stream. In many instances also the adult parasites may have died particularly during attacks of lymphangitis

The pathologic processes due to filariae which produce clinical manifes tations are obstruction of the lymphatic channels of a progressive nature and inflammatory conditions associated with fever Bacterial infections due to atreptococci or staphylococci also frequently play an important role in the production of some lesions Perhaps the commonest effect of the adult parasite is the obstruction of the circulation of lymph in a part In some instances, a single worm or a bunch of worms may block the thoracic duct and act as an embolus or may give rise to a thrombus or the worm may cause an inflammator; thickening of the walls of the vessel and so lead eventually to obstruction and occlusion. In other instances the smaller lymphatic vessels particularly of the glands may be similarly occluded. As intimated the occlusion of the lymphatics may prevent microfilariae from reaching the blood stream and their disappearance may occur immediately after localized lymphatic inflamma tion If obstruction by the adult parasites takes place as high up as the thoracic duct large varicose dilations of the thoraccic and retroperitoneal lymphatics may be produced Similar obstruction of the large abdominal lymphatics may give rise to chyluna if transudation of chyle through the distended or ruptured lymphatics into the pelvis of the kidney, the ureter or bladder occurs Vancose dilations of the lymphatic vessels of the inguinal iliac testicular spermatic regions and of the skin of the scrotum or labia may also occur Hydrocele frequently results and the incidence of hydrocele has been shown in India to be high wherever filarial infection was high where filarial infection was absent, hydrocele was found to be rare The lymphatic glands are also frequently affected by the obstruction of the lymph flow due to more or less acute inflam matory or chronic fibrotic conditions caused from the presence of the adult norms or embryos or their towns Living or dead and degenerating worms are very frequently found in the glands and the dead worms may

blood. Also the blocking of the lymphatics may cause the death of the adult filar re-Hence filarial elephantiasis may be regard d as a fate sequel of filarial disease in which there are frequently no longer microf large in the circulating bio 1 tle part becoming progressively larger following rep ted attacks of lymphangitis and fever

Anatomically there is a condition of hyperplasia and hypertrophy of the skin and subcutaneous tissues in a part of the body in which lymphatic and olten venous obstruction has occurred It is the higher degrees of lymphatic hyperplasi in which

there is tumor like solidity which are termed elephantiasis

Histologically the cond tion varies greatly according to the inflammatory stage There is primarily an acute inflammation of the co ium and subcutaneo s tissue fater hypertrophy and oedema in which there is more diffuse infl mmation dilation and sometimes the mbo is of the lymphatics weins and arteries and finally hyperpla ia of the connective tissue cells and cellula intitration with polymerph nuclear cosino philic leucacytes macrophages and plasma cells di tributed about the lymphatic ves els. In the earlier stages where the tiss es are softer and grayish white there is usually much muco doedematous tissue. The consistency however war es and some areas are composed of richly cellular granulation tissue. In these the plasma cells are frequently numerous both in the sk n and subcutaneous tissues and numbers of them are multinucleate. Large evoid must cells may also be present. The colla en material becomes gradually increased in bulk and arranged in coarse bundles parallel to the skin. I naily there is more marked byp colasia of the connective ti su and a general 6b osis results the soft an fling having go on may to the hyperplastic tissue In ad anced cases the a tramuscular tissues m y also be infiltrated by the c nnecti e ti sue growth and the vessels muscles fat a d nerves g adu lly de t oyed. The skin becomes greatly thick ned. It may me sure a veral anches in thickness and be very dense and fibrous. Beneath t the tissues m y be very edematous and 11 bbery and to tan much lymph. The skin is sem times and the but f equintly is pap llary or verrucous and somet mes rodular 1 om the hard hypers lasta of the cutis and sub cut s Somet mes it shows deeper ingmentary a than is normal

While II neherers bancrofts is apparently the commonest cause of endemic or tropical elephantiasis bacterial infection may also bring about a similar condition. Also there are congenital and sporadic forms of different etiology Shatsuck (1010) in an excellent article has enumer ated and discussed these various forms and Kaufmann and Peiminn (1929) have given further details of the pathology

Manson Bab (1010) recognize from a clinical standpoint the following forms of elephantiasis in man

(1) Congenitat o f : I al-senerally kn wn as Milroy s or Meure's disc se atenosis of ma n lympt atic trunks

(1) Pa ant coduc to H b it offs or O tol sil s

(3) Sept 6—lymph tie infect on by streptococci (4) Totic—by absorpts n of urritating tous—su be a chrys robin

(5) Ob tructire-due to tubercul us Rl ads carcinom t u growth syphil's o y wa or to surgical remo at of ma a chain of gl nds

(6) I e as-secondary t venous th ombos s such as phi g as a alba dolens at white leg in parturient wome

The or mion has been rather generally expressed that lymphatic obstruction alone does not give rise to trop cal elephantin in Actu lly our knowledge of the exact cau e and manner in which elephant is occurs in ia certain particula a still obscure

The pathologic changes which occur in the tissues in the immediate vicinity of the parasites consist of an inflammatory reaction sometimes with necrosis followed by fibrosis These changes probably result from toxic secretions of the parasite from mechanical irritation produced

mammary cysts In Manson Bahr a studies they were situated in superficial abserves and in the epitrochlear inguinal and femoral glands

And the single worms are so slender that they are very difficult to find in the ussues after dark and when present in abscesses they are often found dead and partially or completely decomposed Occasionally a small bunch of the parasites is encountered.

particularly in the scrotum

The route by which the microfilianse magnate from the neighborhood of the pursiworm and pass from the lymph to the blood vessels has not been elexity demonstrate. It has been assumed by many writers that they pass from the parent wern by the lymphatic vessels through the various chains of lymphatic glands to the foreign duct and thence to the venous system. However O Connor (1927) points out that this has apparently not heen demonstrated histologically. If the believes from the cut lust study of a case the histologic evidence is to the effect that the microfilianse after leaving the parent worm pass through the walls of the lymphatics and enter through the walls of the small contiguous blood vessels.

It had seemed questionable to the provided of the property of

Dhayagude and Xmm (1923) in posting out the absance of records of flaral lensor of the splera found in 12 splera at suctopy. Is canon which were electable by the saked eye varying in size from a mm to 25 mm. Usually, they were multiple but occasionally only a single notule was present. Histologically the swelling were granulomational miterofiliature subsequently identified as 11 howereft were found in each. There are marked local or general cosmophilas and in some sections grant cells net comprisons. Most in Losa los infections found pan point y clionath nodules in the spleen containing merofiliature about which there was some inflammatory reaction and fibrous.

Path logs of Elephonicasis—There has been considerable discussion as to whether form of elephonicasis to common in many, respect countries actually of Bantonian I for ever there is a very large amount of exidence which goes to show that while some case of elephantasis occurring in tropical countries just as in the temperate zones are not of fibrarial origins there is a common form of elephantissis undoubtelly due to filtrain. Some of the most straking facts leading to such a conclusion are summanted.

by Manson Bahr as follows

(i) The geographical distribution of R scherus barcefu and that of dephantisas correspond where elephantisas abounds there the filtra abounds and view evis (i) I hard I lymphatic vary and elephantisas occur in the same districts and frequently concur in the same individual (i) I Jymph scrotium unopecimenably a filtral disease often terminates in elephantisas of the scrotium (i) Elephantisas of the kg some times super-cores on the surgicar tenional of the lymph scrotium (j) Elephantisas and lymphatic varis are essentially diseases of the lymphatics (i) Tilsan lymphatic varis are essentially diseases of the lymphatics (ii) Tilsan lymphangits (i) As lymphatic varis are both accompanied by the same type of rective lymphangits (i) As lymphatic varis is practically proved to be caused by the filtra the inference appears to be warranted that with rare exceptions the elephantisas of warm chimates—the disease with which lymphatic varis us so often associated and warm chimates—the disease with which lymphatic varie us of the mass on any affinities—significant ball to the same cause

As has already been intimated in the majority of cases of elephantians the morphism are absent from the perspheral circulation and it has been pointed out that the issuisally time on account of the shistraction and fibrous changes in the lymphatic which have been brought about by the action of the fifarms or through secondary shetchial infection. In many of the cases of elephantians is a well as in other pathologic conditions caused by the parasste the hymphatic system has been blocked and here there is less hielphood of the mercollause obtaining an unobstracted 2g to the

Starling (1921) has pointed out that the only way the tissues can recent their applyof options in from the small amounts which are filtered through the blood testells unto the lymph. The increased evudation of concentrated lymph which occurs in inflammatory calculous as the result of injurys is therefore of advantage sime it furnishes an abundant supply of prote n food to be used up in the regeneration of the damased cells.

Bertwistle and Gregg further point out that in elephantiasis the affected part recei es an increa ed supply of protein a the result of recurring attacks of inflamma



tion and it is suggested that this prote n linst diof merely helping in the process of rejust serves by its continuous or perverted action to stimulate the connective tissues to extessive errowth

Dinker and Field more ecently (e.g.) made a very careful study of the conditions governing the removal of pr tem deposited in the subcutaneous tissues of the dog as well as the cell a d proting to tent of mammalian lymph and the relation of lymph to tissue fluid. They I we also stud of the permetability of the eye lines of the dog fou pr te a and show that there is a constant time and attouch the eye lines of the dog to the tent of the condition of the eye lines of the dog to the tent of the eye lines of the dog to the eye lines of the eye lines of the dog to the eye lines of th

so tain; g protein with eventual removal of the protein by the lymphatics in complete lymphatic clastract; n the lymphatics are constantly engaged in removing blood protein which reaches the tissue and fluid from the candidates. If the

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by their activity, or from products of the disintegration of the parasits after their death

The role which bacteria, particularly streptococci play in the production of lymphanguts and elephantusast has long been emphasured and it seems clear that elephantusas often results following repeated bacterial infection of the lymphatic system which has already been damaged by the presence of the filarial worm

However there has been much secent controversy about the significance of battering particularly streptococc or the production particularly streptococc or the production of the condition. From the discussion already given in this article of the pathologic changes produced by the living or dead filarian endependent of the action of backets it seems clear that the filariane may be the primary exerting factor. In many instants between the research of the condition produced by the results of the strength of the discussion of the condition produced by circulatory disturbance in the early stages of the disease constitute a next flavorable medium for the multionleadness of strengthconess and standylogical flavorable medium for the multionleadness of strengthconess and standylogical constitutions.

The observations of Anderson in British Guiana Acton and Rao in India and of Suarez in Puerto Rico and Grace and Grace in British Guiana emphasize the impor tance of the hemolytic streptococcus in the production of elephantinais Grace (1934) concludes that elephantiasis is a manifestation of hypersensitiveness to this organism On the other hand Mckinley (1931) in Puerto Rico who made a study of 38 cases of acute filarial lymphangitia found that blood cultures in all were negative. Cultures made from aspirated material from focal areas of pain and inflammation were negative In cultures prepared from the skin removed from inflamed areas of it cases one culture was positive for a green producing streptococcus another showed s haemolytic Staphyloccus ourcus and a third a Gram positive bacillus. In no case was the Streptococcus haemolyticus isolated In o control cases in which the diagnosis was septic lymphangitis Sireptoroccus haemofaticus was isolated in 7 and Staphylococcus sureus in 2 cases. He coochides that there may exist in at least 3 types of acute lym phangitis (1) lymphangitis of bacterial origin (2) lymphangitis of filarial origin and (3) filarial lymphangitis with secondary bacterial infection. In his opinion all the evidence suggests that scute filerial lymphangitis may commonly exist as a disease entity without a complicating secondary bacterial infection. He admits however that the mechanism by which the filanal process produced these attacks without the intervention of other infections is still unknown

O Connor (1932) and Gighoh (1933) from other observations conclude that the presence of streptococci and staphylococci in filanti disease have agmiteance only as secondary invaders, while Suarez (1933) emphasizes that although the filanae may be the cause of the lymphatic obstrution in many cases that the patients soomer or later always become victims of bacterial invasion particularly with the streptococcis and that the role of infection is the sime que now in the formation of elephanticass

Bertwistle and Gregg (1938) believe that elephantiasis may develop in part as the result of excessive proteins from hymphatic endate. The exidate is present as the result of infection most often streptococcal increasing in a part policy of the presence of hymphatic states. They pour out to the protein protein the protein protein for the protein pro

Starling (1925) has pointed out that the only way the tissues can receive their supply of protein is from the small amounts which are filtered through the blood vessels into the lymph. The increased exudation of concentrated lymph which occurs in inflammatory conditions as the result of invery is therefore of advantage since it furnishes an abundant supply of protein fo d to be used up in the regeneration of the damaged cells

Bertwistle and Gregg further point out that in elephantias's the affected part recei es an increased supply of protein as the result of recurring attacks of inflamma



tion a d it is suggested that this pr tein a stead of merely help ng in the p ocess of repar serves by t cout muous or perve ted act on to stimulate the connective tissues to excess ve growth

Drinker and Field more recently (933) made a v ry careful tudy of the conditions govern by the removal of protein depos ted in the subcutaneous tissues of the dog a well as the cell and prote a content of mammalian lymph and the relation of lymph to tissue fluid. They have allo studied the permeability of the capillaries of the dog to protein and show that there is a constant tran udation through capillaries of a fluid co taining prot in with eventual removal of the protein by the lymphatics

In complete lymphatic obstruction the lymphatics are constantly engaged in removing blood protein which reaches the tissue and fluid from the capillaries - If the

lymphatic drainage is blocked and the blood circulation normal but one result cat the expected namely the amount of postern in the tissue fluid must rest as a hostinally high concentration. This will be due to the first that postern will leak straidly from the blood capitalizers and owing to the reabouption of water by three weed from must be an increase in concentration of the protein which they cannot absorb and which cannot get out of the part of the protein which they cannot absorb and which cannot get out of the part by the usual lymphatic rotate. In addition to blood posters it is probable that broken down white blood cells must also accumulate so that the normal cellular environment in the part is converted into one containing a hy centage of blood protein plus products of cellular disintegration both of which ow poments would be steadily removed if the browhates were functioning normally

Experimentally they have been able to produce per: 1 tent lymph ocdema in the for a dog through the injection into the large bymphatics of matriers of outsided lised plasms plus crystalline silica and calcium chloride or by using a per cent quark hydrochloride with silica. The first spection results in a swellen leg but in two to four days it subsides. The operation is then repeated at intervish. In one dog from the normal leg the lymph contained or jre cent of pintien and from the smollen leg is 9 per cent of pintien and from the smollen leg is 9 per cent of pintien of from the smollen leg is 90 per cent of pintien could be produced reload.

foreign body reaction to the derosited fibrin

With reference to the matter of infection in conoction with the development of fibrous overgrowth they point out that used tracumatance of infection in a part with obtructed lymphatics, the result can solve he intensification of the finding postulated from lymph blockage alone. Under such circumstances the use before clotted blood plasma emmeshing cells in various stages of disintegration. There is ofting a first property of the matternal. It must remain as deposited to undergo above to time in their opinion this abnormal its use fluid acts as a culture medium past as does in itsuse culture experiments outside the body. The first group of cell to develop the actively are the first-bolists. Thus is true in it succultures and it is apparently in the body when a rection in present rich in blood portion and yrmphatic object to in the blood capillaires also less proteins in high concentrations and again the environment for fibrous overgrowth as postuded in pages intensive form.

From more recent experiments upon dogs Drinker Iseld and Homans (1934) conclude that experimental elephantisus may be called forth in a typical form by lymphostasis alone and that it may without other miliuen e progress to an advanced tate of fbross and deformity. In the experimental and human diseases the same high protein concentration in the tussee fluid occurs. Both lymph and tresue fluid in this condition have from 2 7 to 5 per cent protein instead of the normal r per cent As this concentration times toward that of blood serum fibrosis also increases and aggravates lymphostasis so that a vicious circle of protein concentration and fabros s is set up Once el phantiasis is established in the experimental as well as in the human disease there may set in the same recurrent artacks of fever and local inflammation usually st oken of as lymphangins Haemolytic streptococcus can be cultivated from the ti sue fluids in the early hour of each attack in the dog and at no other time The same bacters may call forth a typical attack in another animal when injected in appropriate quantity into a lymph obstructed leg and not wh n injected in even much greater quantity into normal tissue. The resemblance of the elephantiasis produced in one dog to human elephantiasis was striking

In summativing this discussion we may say that obstruction of the hyphratic ve sels and bacterial infection are the two most important agents to be recognized in the causation of elephantiasis. When such obstruction has been e tablished acute lymphangisis almost imanably follows. The lymphatics in the conditions of lymph oederia receive 23 increased amount of protein as a result of the inflammation which serve the state of the triple of the tripl

resulting in fibroas of the skin and subcutaneous tissue. In tropical countries the adult filarise are the commonest primary cause of the livemphatic obstruction. In the great majority of cases infection with cocci particularly streptococci ultimately ensues. Nevertheless elephantiasis in the tropics as well as in temperate climates may result entirely independently of filarial infection.

CLINICAL MANIFESTATIONS

Filanal Diseases—The important pathologic conditions associated with infection with Il uchereria bancrofts are related to the lymphatic system

They are (i) inflammatory givin no to bymphosogius and elephantoid (ever bymphosomis orth; is and inflammatory various go oniginate and obsers strondary inflections with interplacence and staphylococci and sometimes giving no in to fatal perintin its; (i) altitude of the prophastics without reprint giving no in the to art typing because cuttaenous and deep and produring conditions such as lymph across of sedenovars. (2) diation with replace giving rise to hymphorizons and lymphu is not chiphosomis contributed and displaced hypothesis and the sedenovars. (2) diation with replace giving rise to every another man me and other managements.

Lymphangus, Elephantod Fever and Adentis —The febrile acces uous that accompany the recurring attacks of hymphangus in elephan tiasis I) mph scrotum and other filanal manifestations are very important becau e they may lead to errors in diagnosis. Thus in Barbadoes where until recently there was little or no malana a condition in which there occurs a high fever of sudden onset with rigors and sometimes though not always associated with erysipalations redness of leg or acrotum and by Jymphanguis and painful I) imphatic glands has given a suggestion of a malarial paroxysm

Lomphanguis — The condition of lymphanguis may be dependent upon the intration caused by the presen e of the blara which may be suther alive or dead in a lymphatic vessel. As a result, the lining endo thelium of the lymphatic may become prodiferated necroic and des quanated and the contents of the vessel coagulated. Infection with eight respective to the contents of the vessel coagulated. Infection with eight respective to the process may go on to suppuration with formation of an abscess in which the dead or calcified flarane may be found. In some instancer, resolution occurs in chronic lymphanguis there is great prohiberation of the intima more or less complete blocking of the lumen and general hibrors of the walls so that the vessel becomes thickened. Thanse may be found in the vessels sometime embedded in the fibrorul tissue or in a caseous mass in other instances in cyst like dilutions of the lymphatics as described by Maultand Daniels. Manson Bahr and other supplications.

ov Maitand Daniels Manson hang and others
The attack of hymphangits may be preceded by a fit of shivering and
is always accompanied by fever often lasting several days and varying
from not to toq F. Also there may be severe headriche vomiting and
some delinium rarely suppression of quine and sliburanting. The affected

part is oedematous and often painful to the touch. If the extremities are involved the swollen lymphatic vessel may be palpable as a hard cord like substance, which is often visible, the skin is diffusely reddened or erysipelatous in character or red congested streaks may be seen over the inflamed lymphatic vessels. After several days the swelling of the limb usually begins to subside and the attack may end with profuse diaphoresis A lymphous discharge may occur from the surface of the skin In other instances, infection with streptococci or staphylococci may lead to abscess and even to gangrene, especially if the scrotum is involved. In some instances, the part appears to return to its normal condition in others the skin may remain more or less infiltrated. At various intervals of time weeks, months or years apart similar attacks may recur, eventually leading to hypertrophy and perhaps to elephantiasis The microfilariae may be present or absent from the blood or they may disappear during the attack not to reappear The inflammatory process may not be limited to the superficial vessels but may be particularly in the deep lymphatics. Those of the spermatic cord, testes and retto peritoneal tissues are frequently involved

Elephanioid fever may occur at varying intervals of weeks months, or years in association with most forms of filariasis. In Barbados where sometimes malaria has been suggested it has been commonly called ague, in Fin it is termed 'hinva (Castellam) and wanganga (Manson Bahr) In India this form of recurrent fever has been attributed by Banerjee to mysterious lunar influences. The onset of the fever is usually sudden and the temperature may reach 102 to 104 F It 15 often accompanied by rigor and sweating The temperature may touch normal within 24 hours or it may last several days. In some cases especially those associated with elephantiasis the fever may last a month or so (Stephens and Yorke) Microfilanae may or may not be present in the blood. In many cases the fever is associated with lymphangitis but in other cases the paroxysms may occur independently of lymphan gitis In such cases the reason for the rise of the temperature is not always clear Manson Bahr suggests that in this form there may be an inflammation of the deep seated lumbar lymphatics or glands which are not visible

Lymphadenitis of the associated glands usually accompanies the attack of lymphangutis of it may precede it. The enlarged glands are usually painful during the attack.

However in other instances the groin glands may gradually as unre a various condition and coinsiderable size without any noticeable symptoms. Both groin only one may be affected or the femoral glands of both index may be involved. Some times the condition is associated with yands scrottin. The sociation will be interested to the sociated with yands scrottin. The sociation is associated with yands scrottin. The sociation is the sociated with yands scrottin. The sociation is the sociated with yands when the scrotting is the scrotting of the sociation is the sociation of the scrotting of the scrotting is the scrotting of the scrotting of the scrotting is the scrotting of the scrotting of the scrotting is the scrotting of the scrot

in patients from the tropics should always be regarded as possibly filarial in nature. After herma his here excluded in these cases: removal of a few drops of lymph with a hypodermic needle may reveal on increasing examination the microfilaria or owa or the microfilaria may be found in the circulating blood. Frequent attacks of lymphangitis in these glands leads to fibronic changes and great enlargement. In some of the Pacific Islands southly in Fig. great enlargement of the hypothetic glands with the proposal control of the results of the proposal control of the state of the proposal control of the state of the proposal control of the cotal population. The group glands were also were much enlarger than the proposal control of the total population. The group glands were also were just the proposal control of the total population. The group glands were also were just the proposal control of the total population. The group glands were also were just the proposal control of the total population. The group glands were also were just the proposal control of the proposal cont

Funchits lymphs gits of the spermatic cord is common and is frequently associated with lymphangertas in which cases the cord is actively tender and the scrotium inflamed. Hydrocide may also e it and there may be inquint admitted. Hydrocide may also e it and there may be inquint admitted in given the server cases scoondary infection sometimes occur is often accompanied by frequent if go is Septimenim rely result and then death not infrequently occurs. In some minations at job innovier meanmanton particular hydrologications of the comma in Expris a chronic reso ophise financiative characterized by fifteens there exemine in Expris a chronic reso ophise financiative characterized by fifteens the control of the comma in Expris a chronic reso ophise financiative characterized by fifteens were found in the control of the characterized to the the times of each case.

Filaral orchits and hydrocele are also common conditions. The orchits usually begins with pain in the testicle accompanied by fever and sometimes by rigors. The testicle enlarges rapidly and may some times reach the size of some 10 cm in diameter. It is tender and painful An effusion usually forms in the tunica vaginalis. Persistence of the jimph which may become coagulated may give rise to filarial hydrocele lymphocele or chylocele may result. The swelfing may subside completely in a few days or may leave a permanent thickening. Recurrences of the attack are common.

Involvement of the retroperatoueal lymphatics may also give rise to a serious con dition. Stephe s and Yorke classified under this term the conditions described by French wrsters as filarial cohe and probably the fever and ague of the and men of other writers. It is the acterized by acute abdominal pain vomiting hiccough rigidity of muscles meteorism at times by rete tion of urine and usually by fever Wi e also described a simil r condition in Br tish Guian u der the term filarial septi A derson who has especially observed this condition points out that the symptoms of periton tis are r p dly developed and that a streptococcus is invariably p esent in these cases In Wise's cases the condition was found post mortem to be an acute suppu ative inflammat of retroperatorical lymphangiovarices the dilated lymphatics w e filled with pus Adult filariae were found in the pus in 3 of the 3 cases examined. The abdominal less in was a sec indary one and in e ery case with one except on was connected with a similar les on outside the abdominal cavity as f r exampl in the glands of the i guinal cervical or anillary regions or with suppu rative lesions of the scrotum and cord or abscesses in the I g or arm Strept cocci we e frequently found in the affected lymphatics

Hydrocele—The condition often suggests in the beginning a simple attack of epididymitis. A common result of inflammation or of blocking and dilation of the lymphatics in the region of the testicle is effusion into the tunica vaginalis. Low points out that a favorite site of the adult

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filaria is the epididymis, and if it sets up inflammatory changes here a hydrocele is often produced Hydrocele or chylocele according to whether the exudate is straw colored and lymphous or milky and chylous, is often associated with orchitis or may begin with symptoms resembling epididy mitis It is a very common complication of filarial infection and in the Philippine Islands it is perhaps the most common pathologic manifestation of filtriasis Burton (1928) is Samoa and Pao (1932) in India have shown that there is a relatively high coefficient of correlation between the presence of microfilariae in the blood and the presence of hydrocele

In 21 cases observed in Samos the microfilariae could be demonstrated either to the blood or the hydrocele fluid of 12 Pao found that in the district of Cuttack which showed the highest filarial infection (microfilaria rate 25 per cent) also showed a high incidence of hydrocele (15 per cent) Grace and Crace in British Cuiana found the microfilariae rate of infection (both sexes) 231 per cent and the hydrocele rate (in miles) 12 3 per cent Microfilariae are frequently absent in the hydrocele fluid Rao in 143 cases found microfilaria present in 14 but O Connor in I uerto Rico failed to find them present in 20 cases

The condition is in many instances independent of any secondary bacterial infection In other cases however when the condition is associated with orchitis and a sudien febrile onset secondary infection with coces is usually present. Buxton found in 70 per cent of the patients carefully examined at operation that the condition was bilateral suggesting trauma or secondary infection as an important factor in etiology in such cases rather than blocking on both sides with filariae O Connor (1929) and Manson Bahr report cases showing that hydrocele may often result from repeated sttacks of flarial lymphangitis in which cases the sac is generally thickened and often contains calcified filariae

Lymphorehoea -The lymph or chyle may escape from the lymphatics in other parts of the body for example from the superficial lymphatics appearing on the surface of the akin after attacks of lymphangitis the infiltration and chylous effusion of the tunica vaginalis may occur and give rise to chylocele which Manson Bahr has found not to be uncommon and which is sometimes associated with lymph acrotum or with adenovaria

Chyluna -One of the most striking pathologic conditions associated with filariasis is that of chyluna This results first from obstruction to and dilation of the thoracic duct or of some of the abdominal lymphatic vessels communicating with those which carry the chyle from the intestine Finally the rupture of some of these through the mucous membrane of the urmary tract takes place with the result that chyle appears in the urine frequently rendering it milky in appearance. Owing to the general congestion and dilation in the region rupture at the same time of some of the smaller blood vessels may also occur when blood in addition appears in the urine and haematochyluna results

The urine in this condition may assume various shades of pink or rose. In many instances the ruptured lymphatic contains no chyle and then only lymph appears in the unne and the term lymphum as originally suggested by Low is more appropriate or if blood is present hacmatolymphuma. The chylous urine obviously contains a larger amount of fat derived from the lacteals of the intestine. It usually consults the containing the larger amount of the standard forms and the larger amount of the larg rapidly and after standing there separates an upper fatty byer and a pink or rose-colored sediment , ith a semi transparent gelatinous layer of coagulated lymph between The color of the urine varies according to the amount of chyle or blood present Usually

the morn ng urine is less milky and contains less blood. Sometimes it has the appear a ce of café au last or may he reddish. Alb m n is always present. In chylu a the fat according to the invest gat one of Young frequently amounts to between 1 8 to 2 6 per cent The sed ment of the urme usually reveals lymphocytes and a variable number of red blood cells and frequently microfilarme However the latter are not always present but their absence does not exclude filar asis. M nami and Ehara report a case in which in crofilariae we e present neither in the night blood nor in the chylous urine ne ertheless on removal of the kidney a female filaria apparently alive was found in a lymphatic gland about the hilus of the kidney Microfilanae were pres ent in the fluid about it. The escape of chyle may occur : to the pelvis of the kidney the ureter or bladder and the chyl us fluid may undergo spontaneous co g lation and give r se to obstruction of the ureter or prethra and retention of unne. In 2 cases eported by Minami the congulation of the chylous urine occurred in the pelvis of the leit kidney and in each ease the pa n and d scomfort were sa d to render removal of the kidney necessary. The kidney showed byahn degeneration of the convoluted tubules with exuded plasma in the lumen and in many of the glomerular capsules Minami and Ch r state th t changes in the Lidney were evident in 76 5 per cent of the cases of chylums they collected from the hierature

The attack of chylura is usually abrupt Sometimes it is preceded by pain in the back or aching sensations in the lower abdomen thighs and peritoneum perhaps due to the great distention of the lymphatics involved. At times the attack is accompanied by feer in other cases retention of unne due to congula or the passage of milky or reddish unne may first attract attention to the condition. The attack usually lasts only for a few days particularly if the patient remains in bed but more rarely it may persist for a considerable period. Recurring attacks are usual with intermissions lasting days months or years.

In mid cases the health does not suffer but nise out once with the loss of in ge amounts of allowing debthy depress o and nateman may result. Retention may give me to more serious of a rhances and myny to the k do y. Although chylunts in as it it a curround of that fir sectromary near the Practic Island. But it necessaries as it it a curround of that fir sectremely rare in the Practic Island. But it necessaries only a cases from Sannos during his invests atoos the cit bough some two years Anderson (cray) found that among op patents who writed his chincil in Birth 6 Orans on chints was found in c per cent and chyluns in 1 g sec cent while Grace and Grace chincil in the control of the control of the control of the control of the children of the control of the control of the control of the control of the children of the control of the control of the control of the control of the children of the control of the children of the control of the

Chylous Ascites—very rarely the chyle may exage into the pe ite cal cavity in agree to chylous societie or int the it te me g is up to chylous sorieties or into the item of the about the children of the chi

Lymph Scrotum—In the cond ton kno. no stymph account the nest soften with there foll well by me or all se stangement of the part and us con and tortuous lymphatics. They need may be seen and it. In some interest the scrotum appears covered with number at small vessels their may vary from see and miller meters to e on the contract of the scrotter of the contract of the contract of the contract of the or ruptures an exactle of mills one of the contract of the

siderable enlargement of the scrotum 500 ec or more of fluid may exude in 24 hour and this exudation may continue for several days. Stephens and look report that in some cases periodic discharges may occur for two to three years threatening the life of the patient from exhaustion and accessitating removal of the scrotum. In may cases lymph scrotum is associated with enlarged or various glands of the 500 million with chyluria. A gradual transformation from lymph scrotum to elephanticss of extorium may occur with eryspectations mainlesstations. Lymph scrotum with continuous court with eryspectations mainlesstations. Lymph scrotum with the southern Pacific fisheds as a complication of filtratis.

Action and Rao (1930) who report o cases of lymph serotum point out that in ever one there had been an antecedent operation for hydrocel. They take the view that hydrocele or chylocele is really an overflow reservoir for lymph diamned take hydrocel lymph nodes and that when the sact is removed its function is taken up by a didition of the lymph vessels which may result to lymph scrotum. Vicrofilante were present in the lymph from the scrotum in 7 cases but in only one of these in the hold

Varicose Groin Glands (Adenovaria) - Lymphadenitis associated with lymphia

gitis has already been discussed page 1316



Pio 300 -Varicose lymph glands (Mer Taniguchi Kumamoto)

The term various glands (referring especially to the glands of the groun of the amila) has been used by Massoo and inhers for many years to imply the soft meror less folulated swellings in what dilation of the lymph vessels have occurred. Stephens and tork share the stephens are considered used by members of the conditions which the states probably analyzed the states probably associated used by members of the states are stated to the states and in sudous one one to several entirest in a dameter. On playston the sensition of coiled cubber tubes which collapse on sirm pressure may the obtained and accompanied by fever. Puncture yields a fluid which may or may not contain mercofilarized. The condition is commoned to the male sex.

Filarial Abscess —As a rule injury to the adult filarial worms which results in their death is not followed by abscess formation hot such termination may occur. As

regards location. Wise and Minot found filanal ab cesses 31 times in the pelvis of the k dney 18 in the epid dymis ra in the retroperationcal tissues 25 in the inguinal glands

4 in the il o psoas muscles and 8 n the lymphatic vessels

Stephens and York emphas ze that the d sease may or may not he associated with the presence of filana in the absce s | Len a d failed to find filana m | abscesses e am med by him and Ma vell found adult filama in only 1 of 23 abscesses while Manson Bahr found adult filana in 1 of 8 superficial abscesses W se found filana in 22 of 28 superficial abscesses in 3 of 30 retroperstoneal abscesses and in 10 of 15 abscesses nvolved in the epididymis The pus usually contains pyogenic organisms but may be sterile Manson B hr who examined 8 cases bacteriolo ically found staphylococci in 6 streptococci in 1 and both organ sms in 1 while Wise in 8 cases found staphylococci in 4 streptococci in 21 while 3 were sterile Anderson in 2 study of filanasis in Bitti h Gui ana met with nearly 50 abscesses but found parts of adult filana in only 2 In the examination of 48 abscesses streptococci were found in 41 staphylococci alone in 5 diplococci in z and one abscess appeared sterile

Secondary Infections -The investigations of Anderson emphasize the importance of bacterial infection in fatal cases of filariasis. He had the opportunity of performing postmortem examinations on 28 cases which showed evidences of elephantiasis and filariasis. The cause of death in 14 out of the 28 cases was acute septicaemia The cases of acute septi

caemia were generally diagnosed as abdominal filariasis

In each of these cases the acute septicaeous took its origin from some inflammatory f cus in the lymphatic system and ended with great septic en orgement of the retro perito eal lymph channels. The other common f ctor in all of these cases was the presence of filarial parasites and he remarks that it remains a difficult problem to assess the nathologic potentialit es of this factor. He no nted out that some investigators have put forwa d the suggestion that the chain of symptoms may arise from blockage of some part of the lymphat c system part cula ly the thoracic d ct by one or more adult filarize in a dead or dying condition but in none of the cases examined by bim r by h s colleagues was there any evidence of complete occlus on of the lymph channels hy coils of worms Others have suggested that the passaste exercises a pu ely mechan ical function in carrying the pyogen c organ sms f om the peripheral into the deeper lymphatica. The experience in British Guiana suggests rather that the adult filarine I v ng and moving about in the lymphate system prepare the ground for bacte ial invasion. They may irritate or damage the interior of the lymphat ca and the fine internal structure of the gland and a moderate bacterial invasion is sufficient to blaze the trail Anderson points out that in a tropical country like British Guiana where streptococci are so prevalent and abrasions of the skin such a common occurrence where m squitoes are so active and the gener I file al rate so high the serious inc dence of acute septicaemia might thus appear to have a reasonable explanation

Grace and Grace found at St Kitts British West Ind es that when an abscess was found in association with lympha illis the \$\beta\$ kaemalytic streptococc was recovered from the abscess in 26 of 27 ca es and that in c of these 26 ca e the same micropivan m was recovered from the blood and if we spresent also mone case of abdome al filariasis They d d not help e however that their evidence showed that F la a bancroft w s

capable f p oduc ng the lymphanguis

G ace (943) after further study believes that the e tince of lymph st is enders the tissues more suscept his 1 f et n by the beta hemolytic strept co cus and that attacks of lymphangit in v then be occasioned by organismal or toxic stimuli of

nten ty too l to b appreciated by I sues pre ou ly u nvolved

Elephantiasis - This is one of the commonest lesions Its prevalence varies considerably in tropical countries but is obviously related to the degree of filarial infection. In certain districts in Cochin China about 5 per cent of the population show the condition in areas in Samoa about 48 per cent while in the island of Huahine Society Islands 70 per cent of the adult male population have been reported affected by Manson Bahr

In the Ellice Islands with a population of 3 300 O Connor found 120 cases The condition is also very common in the Belgian Chingo and in many other tropical and subtropical countries. It is rare or absent however in large areas of South Africa for example Rhodesia (Blackie 1931) The British Filanasis Commission in British Guiana reported that at one time the proportion of people in Georgetown suffering from elephantiasis was probably higher than in any other city in the world. Let in their studies made in 1921 in a himited area they found the rate at most was not over 5 per cent of the population In 1931 Crace found the rate of elephantiasis in British Guina to be 11 4 per cent. The condition was also formerly very prevalent in Barbidos and is still popularly known in British Guiana as Barbados foot In some regions where infection of the blood with microfilanae is common elephantiasis is rare or absent. Thus Crichton (10 0) in the British Solomon Islands whose survey showed it per cent of the inhabitants to harbor larval filarise in the blood found elephantiasis very rare while Croll in Brisbane. Australia reports that elephantiasis was never observed in the Australian troops examined in spite of the fact that is 5 per cent of the adults had microfilariae in their blood. In this region the climate was very dry. However Cilento (1032) reports typical cases of elephantiasis in Oueensland

Buxton feels convinced that in Polynesia and Fiji elephantiasis is commoner in Europeans than in any other part of the tropics and say gests that this may be due to the fact that the non periodic filans of Oceania is a day biting mosquito, that during the day the European is in contact with the native race and more exposed to the bites of these mosquitoes

The condition is one of adult life and is rare under 20 years of age After this period the percentage rises steadily. Grace found that more

cases begin in the third decade than in any other

The statistics of Manson Bahr show that in 95 per cent of the ca es the lower extremities (either one or both alone or in combination with the scrotium or arms) are the seat of the disease. The foot and ankle only or the foot and leg or the foot leg and thigh may each or all be involved. The condition is usually but not always confined to below the knee Rarely the thigh is involved. The swelling may attain enormous dimen sions. In extreme cases the limb may attain a circumference of several feet.

Next to the leg the scrotum is most frequently involved and the scrotal tumors may attain an enormous size to to 20 pounds are common weights and 40 to 50 pounds is by no means an unusual weight. The largest recorded one is 224 pounds

In elephantiasis of the acrotion the penns is usually not hypertrophied and is an erally incorporated or concealed in the scrotal mass. The testes are often dagged down toward the bottom of the tumor and attached to the under part of the scrotion by the gubernaculum testis the spermance cord being thus greatly lengthened. As a rule there is double hydrocel and therefore, of the tumora varginals.

The arms in most countries are more rarely attacked. However in Eiu for some unexplained reason elephantiasis of the arm is comparatively common. Thoudend to condition to times in 66 cases of elshantiasis observed in the Society Islands. In 12 of the cases it was secondary to elephantiasis elsewhere in the body and only cases pinnary. The conditions begins as a lymphangitis accompanied by feer and adentit of the epitrochlear glands. Repeated attacks of lymphangitis recompanied to reason the large timens or may coever the lumb into a shapeless mass.

Rardy the mammer vulva pean and extramscribed portions of the instruments of the limbs trunks neck or scale para affected. Case of eliphantiass of the mammer have been recorded in wh ch the organ depended to the poles. One such tumor weighed twenty-one pounds after removal. Tumors of the labas or of the elitors or the elitors are in the scale of the elitors are in the scale of the elitors are in the elitors of the elitors are in the elitors of the elitors are in the elitors as the elitors are provided by Hacilla Wight. Sometimes it becomes at the class the leg and reaches to the knee: Eliphantiass of the total bas been reported by MacDonald and of the thin by Correy. One such tumor of the thigh we globe at pounds after removal. In one case of elephantias of the ton us reported by Kehn in light b Elagt Africa the tonger mospected is cheef from the mouth and the lower para large to the elitors are in the elitors and the lower para the elitors are in the elitors and the lower para



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Elephantiasis usually begins as a lymphangitis with fever and secondary demaitts and cellulatis. Repeated lymphangitic attacks with secondary infections with the program cocci give nise ultimately to the deformaties. In other instances the onset is insidious with no instory of lymphangitis and no evidence of secondary infection: the condition arising as a gradual paniless swelling. The lymphatic glands dratting the affected area are generally enlarged. In elephantiasis of the extrem tes the appearance usually varies with the age of the condition. The pathology of the condition has been described on page 1376.

Anderson has distinguished five churcal types in the first there as use 10 y alght uniform eals geneant se a more commonly in younger people in which the limb is a cedematous and there is some thickening of the skin. Bey and the los of shapeliness and the alght increase in eachy it is cause no d as bly of d congride. If at this stage they five t is caref I about pers and byg one p otents the limb from in j ry by some form of covering and practices genetic message the progress of the alghanted could not

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Rardy the mammar vulva penus and curcumsenhed portions of the instruments of the limbs trunks neck or scale pas a effected G as est elephantizas of the mammar have been recorded in which the organ descend d to the pubs. One such tumor weighed twe ty-one pounds after removal Tumors of the labus or of the clutors may also sitem treat use S to no pounds are removal. Tumors of the labus or of the clutors may also sitem treat use S to no pounds are said the scrotum. Is some matances the organ assumes mongrous proportions as a reported by Hazell We ght. Sometimes at become as thick as the leg and reaches to the knees. Elephantizas of the scale has been reported by Mazellonad and of the thingh by Corney One such tumor of the thingh weighed a pound after removal. In one ca of elephantizus of the torque 'emocited by Anilbows and Control of the


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Anderso has de inquashed for ed a cal types in the fart there is usually all plat us form enlargement is sen more a summly in younger people in a back to determine occurrence of the same sense of the same sense that the same sense is the same sense that the same sense is the same s

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may be arrested or it may even disappear. If on the other hand, the patient is cardens of scratches and uritations of the skin chills may occur and attacks of lymphangus with the return flow of the lymph, and hypertrophy of the hab continues.

This gives rise to the second type which is characterized by marked enlargemental irregular shape and great increase in weight. The skin is thickened to a considerable degree. Subcutaneously there is a great increase of latty and throus tissue. The lymphatics become greatly increased in size and number and the muscles become

hypertrophied

In the third type the hypertrophied tissues billow out into rounded masses with deep sule, at the flexures such as the back of the knee the frint of the ankle and at the too joints. The skin is much linkerned and coarse and there is a tendency for a slight abrasion to proceed jo deep andolent ulceration. Abscrises are a frequent occurrence in this variety and the coarse the kenned skin office shows the scars of surgical.

nessions.

A fourth type is the variety known as Elephanhaus services on account of the very coarse warty appearance of the skin. The wards and small bosses appear in gentler profusion around the lower part of the call and on the dorson of the foot most of the foot and the statement of the foot of the statement of the foot of the statement of the foot of the statement of the st

A fifth type of elephantiasis seen in cases of longest duration has the most charseler is the elephantioid appearance. The skin is enormously thickened and leathery and in thrown up into rugae. The subsultaneous tissues hearing readly hypertrophical especially around the ankle and the obliteration of all curs attres gives the suggestion of an elephantine foot. The weight of the lumb is frequently sufficient to emple the patient and in advanced cases his movements are confined to dragging himself about over very limited areas.

Prognosis—Apart from the disability produced from the different forms of elephantiasis the prognosis is good. The condition is a chromic one and patients frequently live for many years except when secondary bacterial infections particularly with streptococci produce septicaemia, when death may occur within a few days.

Rarer Complications—Manson Bahr (1928) calls attention to fallinal synovitis. He says that its occurrence with faland invasion is too common to be accidental. Fibrotic ankylosis often results. In cases where the hip joint is affected removal of the inflamed that glands draining the arts has in some instances appeared to relieve the condition. In severe cases the synovitis may even proceed to pus formation and a fatal result ensures.

DIAGNOSIS OF FILARIASIS

Fresh cover slip films of the penpheral blood finger or ear should first be examined with the low power objective (two thirds or AA). The actively moving lariase when present in fair numbers are usually quick to detect. The specimen should be collected at intervals from 0 o clock, until midnight. If parasites are not found other specimens should be prepared during the day for the detection of other species of microfilariase.

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tis then continued as a retrograde or centrifugal lymphangitis. There was a highly characteristic type of scrotal involvement with funiculitis and there was a tendency to multiple involvement and recurrence Severe constitutional symptoms were absent. The condition of acute lympha denitis and lymphangitis has been designated by the natives for many years as mumu as was surmised by Buyton to be of filarial origin

Sapero (personal communication 1944) recommends the following criteria of diagnosis of filanasis in military personnel in the South Seas 1 Diagnosis of Filariasis (Il ncheria Bancrofts) -The signs and symp-

- toms of filariasis which have occurred in military personnel are often so typical that the diagnosis may be made easily and with certainty Unfor tunately these characteristic signs are frequently not present when the patient first presents himself for examination and in such instances the difficulties in establishing a diagnosis become great. This together with the additional fact that many physicians are not too familiar with the disea e makes it desirable to enumerate the various points which should be the basis for diagnosis
 - - 2 Criteria of Diagnosis
 - 1 A characteristic history reveals
- I Exposure is an area of known fransmission Filariasis i endemic in many areas throughout the world in which military operations are in progress. The disease however has occurred in troops in significant numbers only in a relatively restricted area namely in American and British Samoa and in Wallis Island A few cases have been reported from Bora Bora the Tonga Islands and Funafuts A diagnosis of filariasis in an individual not exposed in any of the above locations should be regarded with caution unless the parasite is found. An occasional relatively rare case may be encountered whose infection was contracted in the New Hebrides or Solomons
- 2 I prolonged sucubation persod characterized by an elap e of many months between the first exposure to filariasis in a known transmission area and the appearance of the fir t signs and symptoms. The greater number of cases occur from the eachth to the twelfth month. Shorter (within two months) and longer incubation periods however have been
- 3. A series of recurrent acute attacks with signs and symptoms as described below usually brought on by sudden strain or exercise. Attacks vary in severity involve various parts of the body and occur and persist for varying intervals. The patient usually remains ambulatory
- B Objectue findings
- 1 Suelling of an extremsty or of the scrotal contents as the commonest sign Extremities The swelling is due to a relograde lymphangitis Heat pun redness and tendernes are generally present but usually not to a marked degree Scrotum There is nodular thickening of the cord known as funiculitis and there may be cord like red streaks. Enlarge ment of the testicle itself and the presence of a hydrocele is not uncommon

On the other hand, Fulleborn and Sonnenschein (1932) have found that in individuals free of filanal infection the skin test, with D immits antigen as well as with Onchocerca antigen, was mostly positive

Rao (1932 1934) in employing the akin test in India used as adupen microfilarue of Il-bonceofii hydrocele flund with and without microfilarue and adult guices wern Out of J. 8 cases tested including those definitely known to be infected with Il-bin crofile and control cases positive reactions were observed in all with every one of the anticens used.

Lloyd and Chandrz (1933) using as antigen extracts vanously prepared of Direction immits examined by the complement firstion reaction a series of 5g cases of sarries chinical types of infection with it barropit. Twenty three positive reactions were obtained in the series. A series of 1g cases of infection by other helmith was also similarly examined yielding 3 positive reactions all of which nee in gionea worm.

Culbertion and Rose (1944) have prepared an antigen from Litomonders (1911) from the pleural cavity of infected cotton rats and have performed both sin tests and complement fination tests with the antigen diluted to 1 200 in carbolazed phron logical salt solution. They have used this tet in III howeverful infection as well as infection with has log and Observers order its. However the reaction is not specific and it seems obvious that further experimental work must be performed before the test can be regarded as of practical value in the disagnoss of III hower ful infection.

INCIDENCE AND DIAGNOSIS IN THE SOUTH PACIFIC

The instance of filarisis has been increasing rapidly in the Fastern Islands of the South Pacific theater Clinical symptoms were usually first noted about 9 months after exposure to infection and after 12 months the number of infections increased rapidly. In some localities the increase has assumed epidemic proportions a total of 3rg cases being reported from one theater. Many have been in troops stationed in the boorty Islands but a significant number have also been reported in British Samos the Cook, Islands. Tongs and Tongerava.

Dickson Huntington and Eichold (1943) have studied 251 cases of acute lymphangitis in our troops in the Samoan region. The following table shows the anatomical distribution of the lesions in these cases. It emphasizes the fact that there were few instances in which the leg alone was involved and they point out that in this region the scrotum was most commonly affected.

rat.	dents with unitateral scrotal fesions only	7,7
Pat	tents with unlateral arm lesions only	45
Pat	ients vith unilateral leg lesions only	4
Pat	tients with bilateral scrotal lesions only	33
Pat	tients with bilateral arm lesions only	11
Pat	tients with bilateral leg lesions only	3
Iat	tients with multiple involvement	
5	Scrotum and Arm	49
5	Scrotum and Leg	6
5	S rotum 1rm and Leg	2
- /	Arm and Leg	3

Buxton in a survey made in earlier years made similar observations Dickson et all observed that the lesion usually started with a lymphadeni FILARIASIS 1326C

demonstrated that Foundm will destroy the nucrofilance in these animals it frequently will not kill the adults even when the drugs used later cause the death of the dog. Brown and Austin (1939) have also reported that stibesol a trivalent animony compound containing sulphur might sterilize the blood of dogs. Of is dogs treated 3 died. While both of these drugs are certainly inimicable to the existence of microfilaniae, it seems evident that the microfilaniae in the human body may not be permanently removed by does of these drugs which are not touc to the patient.

Anthomaline has also been used in human cases but only causes temporary diminution in the number of microfilariae

Brown in recent studies has given 3 cc intramuscularly at daily intervals for 5-r5 injections. Most case showed a marked diministion in the number of microfilarne shortly after treatment and all cases showed a diministion at the end of 6 months. However 30% continued to a greater or lesser extent some so severely that the drug had to be withdrawn temporarily or the dose decreased.

Culbertson and Rose (1944) bave reported that by injections of neostam (stibamine glucoside) they have been able to destroy the adult filtral worm of cotton rats Lamonodes certain which ded in the pleural space. However as noted above Chopra has tried almost all of the pentavalent organic contributions in man without favorable effect. Solusibosan is the most satisfactory of these drugs seep 2.8.

Owing to the destructive effect on haemoly its streptococci produced by sulfanilamide (prontylan) and its related compound prontosal and the favorable results reported in the use of these preparations by Nelson and his associates (1958) in the treatment of 347 cases of ergyspelas there was hope that sulfanilamide may prove of value in the treatment of cases of filarial lymphangitis complexated by haemolytic streptococci. In 406 cases of ergapelas at Bellevue Hospital New York (1935-6) treated with ergyspelas antition in the mortality was in adults 9 per cent in children 37 5 per cent while of 4 475 cases treated (1930-37) with serum ultra volet rays. Nava and local treatments with drespress in adults

2 Lymphadenopathy is almost always present Predominately it is of inguinal axillary and epitrochilear involvement this later being said by some authorities to be very characteristic.

C Laboratory There is no specific laboratory test which is generally

applicable and reliable for confirmation of diagnosis

I Microfilariae —To date microfilariae have been detected in only one or two doubtful instances. Many thousands of searches for the larvae have been made in concentrated blood and in men as long as 21 months after their first symptoms with negative results.

2 Adult Islana —Adult and degenerative adult worms have been frequently detected in enlarged lymph gland biops; specimens. The damage resulting from this procedure however makes it a contrainducted damagnetic test.

3 Complement fixation tests and skin test reactions are of limited

value and are still in the experimental stage

D Diagnostic exercise test

1 Exercise Test—Between acute episodes when physical findings are not present exercise particularly of the type that requires heavy exertion including walking usually instances a recurrence. These recurrence frequently are characterized by such typical physical signs as to leave the diagnosis no longer in doubt.

TREATMENT

In treatment the paychological aspects of the problem should not be lost sight of It has been pointed out that some faintastic worms and erroneous impressions have developed in a number of patients and that there has been flear regarding the transmission of the disease to nives and offspring or that stenity might develop. That these fears are based or unfamiliarity with the facts should be carefully explained. Patients should be transferred from the endemic areas as soon as is practicable and until they are transferred they should be protected from mosquitoes and until they are transferred they should be protected from mosquitoes and this is desirable even if microfilariae have not been found in the blood. The prognosis in early cases is usually excellent providing the individual is not exposed to repeated reinfections.

Drugs -No drug is known to be specific for the treatment of Il ucher eria bancroft infection and none that will destroy the parasites during

the life of the human host

Potassium antiniony tartrate will sometimes temporarily diminish or remove the microfilariae from the peripheral circulation but they

generally return later

Foundin (recontinuessn) a timalent antimony compound antimony procatethin disulphonate of sodium which is less poisonous has a similar but not so powerful a flarizodal effect. Chopra (1936) has tried almost all the pentavalent organic compounds of antimony without any favorable effect. The value of Foundin in the treatment of Dirighters immits infestation in the dog has been studied by Wright and Underwood (1934). Law and Chen (1930) and Johnston (1936). While it has been

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and children the mortality was 84 per cent. In 347 cases treated in 1938 with sulfamilamide it was but 262 per cent. However the drug may be to ome extent toxic and must be used with caution. Buttle (roa) tenoris good results have been obtained in a few cases

Buttle [1939] reports good results have been obtained in a few cases of elephantaus or niarial origin by the administration of quies small doses of prontosi rubrum 15 grm daily for 6 days. A rapid subsidence of pain temperature and swelling followed its use and the condition appeared to be completely cured and there were no records of recurrences.

Ray (1942) who believes that the inflammatory attacks are not do to streptococcal infection but to the adult parasite: emphasias are that sulfamilianted has been effect verwin when no secondary streptococcal infections in periont. For recurrent attacks he suggests induced pyrena by beings tertian in larna. Ramanimorti (1941) has also advised the u. or sulfamilianted but not the und stone of malaria it resulment. Earlies (1941) has also dound straing beneficial results from sulfrayrintne for the lymphadenni complicating flamasa probe by due to strondary strept too ccall infect per consideration.

Since there is no remedy yet known that in effective for the destruction of the filamate treatment must be largely symptomatic. For exactly jumphary gives the treatment should comist particularly of rest and elevant in of the affected part, bealing folions with mild apprients and morph at a face-stary to red is pain. Subsequently the extremities should be elevated and firmly bandgred. Since in many cases of filamal lymphangus there is a secondary infection with appropriate passage longer transportants.

b en recommended by a number of b ervers

b on recommended by a summer of a criver's Vaccine and Serum Trestment—Kone in British Guisma after preparing autogenous vaccines if in utreptoexeci and staphylococca give these in dones of 100 to 200 millions at fortinghly intervals in do cases. He report left that more of the milder rase relapsed a d-only 100 feb q which had lasted more than a ye r. Cood results were also obtained by Wise and Ros in checkin- with vacciner the recurring attacks of

Is mphangits

Aubin and Nades: ha e employed injections of antist epitococcus lipovascane in

10 cases of lymphangitis and elephane as. They claim that a c urs of the ensections

produced right and complete inspressments in the Unit parhagitis with fever and less

severe reflores whether the conditions with a sociated with filmings or not. There was

some shinking to fit the dephangion specime of an ensection of an ensity of gymp forthore.

O Co nor (1932) has had abundant poportunutes to follow up many castes in Justice Ricco where the paint is with filtrail hymphangiats have had vaccine it attents and many k nots of injections. He has f und that f || wong anti treptoc cell wate no thought many placets cases to have a statch for flown in x months to a year but above the heavy many placets cases to have a statch for flown in x months to a year but above is equally c muson following treatment with antiplague serum antidiphthentic serum antitietan ces or and ordinary Y A B wateria against typ bodd fever or used intra venously at posten shock at the total treatment may sool be a temporary cuse from protest shock stated than an other of timent may sool be a temporary cuse from protest shock stated than an index of timent may sool be a temporary cuse from protest shock stated than an when of timents the

Care à d'On « (1931) pounted ut that streptor coal vare on etherapy was in the favor at the Publ of Hospitant in a reptember Buthar Count Hough it was del ficult to discover a sci nitic basis for the attitude. They ha e employed intri mu cular or intravenous imperious of antitutepococcal seriem in the treatment of 47 et e S. S. of the cases were given one intramencularly and one a grant et a e, one or intravenous Hyperious des expressions of the stream of the

have some effect. Chopra and Ra reported some decreas in chyluria and lym phangins after tryparam de injections. Servana (032) has reported that an intermittent harmatochyluria with microfibarase cleared up siter ten mixtumuculur insections.



there is enough sound prepare remaining to cover the distal 2 or 3 inches so that usually there is sufficient sound skin for a c inch penss

The flaps which are to co er the pens and testicles should be mapped out with shallow incisions and care must be exercised that only sound skin is included in these flaps Fauntleroy advises a horseshoe shaped incision commencing at the left side of the base of the tumor about a meh from the thigh and about at the level of the penis in The incision is carried downward and passes just below the opening of the penis on the tumor surface. A similar mersion on the right side completes the horse shoe curve. Ne t a downward ancision in the sound skin is made over the posterior surface of the tumor thus encurching the base of the scrotum. The anterior horseshoe incision is now deepened to free the penis care being taken not to injure the spermatic cord Next the incisions are deepened late ally until the testicles are reached. The



Fig goz -- El oh nt s Bef re ope ton (Fa ntl roy) See F a 303 testicles are usually in the center of the tumor ambedded in a blubbery tissue from which

they can be easily stripped. The remains of the gubernacula are the a booked up and cut close to the testicles. The tumcae vaganules are often thickened and contain fluid which has to be drawn off. In to per cent of I au tleroy's cases it was necessary to remove one testicle on account of exte si e d sease. One must liso bear in mind the possibility of hermal complicat ons and undescended testicle

A sound is now introduced into the u eth a and the s ptum of the scrotum di ided close to the sheath of the penis then dissect g way the blubbery tissue it this stage there may be considerable bleeding. The testicles and apermatic cords are then dissected away from the tunicae vaginales. The pen s is now freed by a circular incision around and above the opening so the anterio part of the mass. The remainder of the ho sesboe flap is now dissected up and the penis freed. The pr minal covering for the penis is made from this horseshoe fl p which is stitched to the distal one shaped from the prepuce carefully trimmed of elephantoid tissue. The lateral flaps are brought

of neostrbosan the dose rising from three fourths of a grain to 5 grains. However on the whole drugs usually are apparently of little value in the treatment of this com plication Patients subject to the condition should have rest in hed laxatives and restriction of fluids and fats. The chyluma is often relieved by avoidance of fat in the diet

Manson Bahr (10.16) especially advises washing out the bladder with some bland substance such as borne acid and if there is an admixture of blood styptics may be added Chopra (1936) has found that sodium entrate in large doses is of value for the

prevention of tlotting of the chyle in the bladder

Golden and O Connor (1934) have treated 7 cases with roenigen rays applied in the kidney region While owing to the short series of cases and the short observation periods (3 months to 3 years) conclusions are tentative in all of these chyluna crased for at least the time coincident with treatment

Sureveal Treatment

In elephantiasis of the limbs much may be done in the early stages by rest and elevation of the affected part and constriction by bandaging and the use of elastic stockings. Massage may also be of assistance Anott (1038) has found after experiments with 105 unselected patients with elephantiasis of the legs observed during to months that treatment with pressure bandaring with cotton elastic crepe gave very satisfactor) results in many instances. He found that prolonged firm bandaging effects a gradual removal of the lymphoedema in filarial elephantiasis of the leg the patient gets prompt symptomatic relief from his discom fort and recurrent attacks of lymphangitis often cease

When the elephantoid tumors reach a size which greatly inconven lenges the patient operative measures may be undertaken. The most satisfactory procedure in cases of scrotal breast or labual elephantiasis is removal However sometimes following removal of the affected part elephantiasis elsewhere particularly of the legs may occur

In elephantiasis of the scrotum it has been stated that the important question involved as the removal of a burdensome mass which however is in no way a source of danger to the life of the patient. At the same time such patients are subject to attacks of elephantoid fever a condition not without its dangers. There is one factor not usually brought forward and that is the remarkable effect of a successful operation on the mental state of the patient. This is well shown in the accompanying illustrations of the patient before and after operation II sexual deficiencies are of so powerful an influence on persons of education how much greater must they weigh na an uneda cated native with but few of the higher interests of life

Prior to operation the patient should be kept in bed for a day or so to lessen the amount of fluid and to secure relaxation of tissues Thorough scrubbing with soap and water the day of and the day before the operation and the use of sicohol as an antiseptic

are important. Some prefer sodine

For the operation the hthotomy position is employed. An assistant supports the scrotal tumor a rapped in a sterile towel | Fauntieroy does not recommend a tournique! to the base of the tumor as in his opinion it assists but little in controlling haemorrhage and endangers asensis Hacmostats answer better and as the vessels which give most trouble are deeply satuated the clasic cord would not affect them In some cases there is very little bleeding. The upper part of the pear-shaped tumor usually affords sufficient sound skin next the thighs for the flaps. As a role, the elephantoid issue does not involve the upper 2 or 3 mehes of the skin anteriorly which is thus available to cover in the base of the penis. In addition to this covering for the penis, there is a long pre more which has been considerably stretched so that after removing all elephantoid tusue Voice awa (1938) has student the chances for transmission of IF wide cross baserfit by the intermediate measures of the fairness. He found that the matter learner from the me quite fairled the positive the normal skin of mice and set up an infection. However by the aga faction of larvae wegended in saline substant over the brothen skin of me extincted number accepted in entering the substantiances it source. Also when farvae were set free from an infected mongative during the act to fairly only he were explicitly of the wrone capable of invading the de per timize by way of the ordines left by the bits. (If should be boyer in mind by a trust are not normal bosts of W. Baserfit | From his septembers.)



Pic 3.3 - El ph at a i f the sc turn. After operation. Note chang h m nist ter (Paunil 109). Con paré with Fig. 3.2

Notagons concluded that for not frient to fake place an onfice by which the larvace range and an entrance und the tensors hould be present and that there must be sufficient mosture for the farrase to work their way actively into the slain by such an onfice librace the chairs of the farrasms too on fifters as by them say to be furthed by a number of adverse factors which may somet uses expla a why the immegration of infected persons and dustination indicated with a rank towns to be expedite carriers of the parasite. I filarize sides when the start outlivers so the milection and such districts are not cover teed time fresh endomes.

Prophylarus should constat in (a) the destruction of the mosquitoes and their breeding places a specially in the neighborhood of welling houses and (a) protection from the bites of mo quitoes. Every carrier of intariast with mercoflarare in the blood is a danger to the community and should be isolated or protected from the bites of mosquitoes especially at night by a mosquito net.

O Common and Beatty (1938) after much study and exper ente recommended that in areas of high human and most nite infect e incidence the following local measures should be carried out

together with linen or silk worm gut sutures feaving space for a drainage tube and at thus form a new scrotum for the testicles

The mortality following amputation of large scrotal tumors does not generally exceed 5 per cent even in countries where asspits suggist technic is difficult to obtain Fauntlerop, who performed 149 such operations in which tumors ranging from 10 to 85 pounds in weight were removed, did not lose a case.

For elephantisass of the leg an improvement in the surgical testiment has been made by hondedon who by removage long broad strips of the hyperplastic subcutaneous tissues down to and including the deep fascis in the leg aimed to establish an annior mouse between the deep and superficial fymphatics. A modification of this operation has been advocated by Auchincloss. The operations necessary are usually performed in successive stages. Auchincloss has made use of the constigent ray before the operation to disclose areas of extensive fibrouss of the subcutaneous tissue with funkening and obliteration of the viessels and hymphatics calcification of the filantial worms together with calcification of the hilood vessels and the presence of filantial worms deep in the subcutaneous tissue or lying in the deep fascial thereby removing the diseased tissue and the filantial worms group in numerate constant with its disease of the subcutaneous tissue which then less in direct contact with its must be caused in the filantial worms of the subcutaneous tissue which then less in direct contact with its must be constanted.

Bertwistle Auchincless Torgerson and Del Toro have recorded good results from these methods of operation upon elephantisms of the leg. However, it is only siter several years that the real value of the operation can be determined ance siter long

periods of time the elephantiasis and attacks of lymphangitis may recur

Abstest should he treated by the usual surgical procedures such as hot comprosor, evacuation irrigations and antiseptic dressings. As a rule various gront gland (dedireners) should not be operated upon for the removal of the glands is likely to be followed by elephantissis of the lower extremities or itritating lymphorrhota may exult

Golden and O Connor (1034) have recommended the resettent treatment for lymphangiss and adamiss. Fifteen cases were so treated. At first merely foat spoish were translated but later the entire feg. The impression was gained that large derit and more prolonged treatment gave better results. Four cases so treated had no further statics in two attacks were as before translation, while in some others judg

ment nas difficult

Recurrent attacks of filarial orchites usually lead eventually to hydrocele. For filarial orchits with effusion must the tunies vaginates. Markind recommends into onto the tunica turning out any clots that may be found in the sac and stuffing the latter.

with iodoform gauze

Lymph stroken should be supported by a suppensory bandage and protected against the slightest athanon. It should be kept scrupplously clean and sell powdered with talcum. Only if inflammation is of frequent occurrence with debultating lymphor rahgan and passes into eliphantases of the scrotten in surgical removal recommended to the experience of Manion Bahr violent surgical interference with the lymph vances of the scrottum may result in chlymna or eliphantases of the leg

PROPHYLAXIS

O Connor and Beatty (1938) in the study of filanasis in St Crux Virgin Islands where filanasis is very prevalent found in the examination of 5000 Culter fair, and 19 2 sper cent contained fully developed infective larvae and they concluded for various reasons that less than 1 per cent of Culter fair, are in the infested region succeeded in so depositing their larvae as to insure the latter entering their definitive host man Volugina (1938) has studed the chances for traum soon of II where a ba croft by the intermediate mosquito Caller diagram. His found it at the mature lar as from the mosquito fall did to pencitrate the normal skin of mice and set up an infection. However by the application of larvae temperaded is and in solution over the brothen skin of mice a limited number succeeded in entering the subcutaneous tassues. Also when larvae were set free from an infected mosquito daming the act of hiting only a few were capable of invading the deeper t suces by way of the onfice 1 left by the bites. (It should be borne in mid that mice are not normal hot sol W is croft) From the experiments.



et (Fau ti roy) Comp ewith Fig 304

Notagasa concluded that for safect on to take place an onfice by which the larvae in y gun an entrance into the it sue should be present and it it there must be sufficient mosture for the larvae to work their way actively usto the kin by such an onfice Hence the chances of the transmission of silians as by the mosquitos is finited by a number of all erre factors which may sometimes explain why the immigration of infect of persons into districts infected with mosquitors whi have known to be capable carriers of the parasets of fit raiss does in it sate outh eaks of the infection a d such districts are not one circle into fresh endern ce ters

Prophylaus should consist in (i) the destruction of the mosquitoes and their breeding places especially in the neighborhood of dwelling houses and (a) protection from the bites of mosquitoes. Every carrier of filariasis with microfilaria in the blood as a danger to the community and should be solated or protected from the bites of mosquitoes especially at night by a mosquito net.

O Connor and Beatty (933) after much study and expenence recomm nded that in areas of high human and mosqu to infective suciding the the following local measures should be extracted out.

- 1 The nature of filariasis its transmission and prevention should be completely and simply explained to the occupants of the house where control measures are instituted a Suitable containers for potable and other water supplies should be adequately
- screened with wire netting Where contaioers are not suitable they should be replaced as The use of the mosquito net should be demonstrated (If the occupants cannot afford them these should be provided from public funds)
- 4 The proper maintenance and use of all screeoing should be supervised at intervals
- by the existing sanitary officers
- 5 When possible occupants should be encouraged to keep fowls in their yards new the house owing to the fact that Culer fatigams is perhaps almost as partial to this kind of blood as it is to human blood and hence fowls may aid to distracting mosquitoes from biting man
- 6 The number of mosquitoes in the houses and the percentage of these which are infective should be recorded from time to time in order to evaluate the results of preventive measures.
- 7 Efforts to have adult mosquitoes killed daily by the inhabitants while highly desirable will usually be found impracticable. This measure would be too expenses for government maintenance but where full cooperation is assured should be adopted to supplement the foregoing.

MICROFILARIA MALAYI (Wuchereria malayi)

Another sheathed mucrofilaria of nocturnal periodicity has been described under the name of Microfilaria malay (Brug 1937). According to Lichtenstein Microfilaria malay (Brug 1937). According not only morphologically but also biologically. Until 1940 only the microfilaria barrafile mucrofilaria barrafile microfilaria barrafile microfilaria exported finding the adults from a lymph filled cyst in a patient which showed only 1f malays in the blood. Chandler noted that these adults were very similar to II underens barrofils. The females as described were indistinguishable but the male of malays is reported to differ from barrofit; in such minor details as the number of papillae and the structure of the spicules

Low (1942) suggests the name of 11 bancrofit malay; owing to the slight differences Manson Bahr points out that 11 pacifics should not be confused with this species which he remarks may be one in evolution which Baylis (1942) prefers to regard for the present as a subspecies

which Bay his (1942) prefers to regard for the present as a subspace, which all some C and his associates (1941) have also reported the finding of the adult and female of II malely in a male Maley patient who died from unoppus after an operation for vessel activities. The patient did not show symptoms of fluming and the state of the control of the control of the state of the control of the state of the control of the state of the control of the control of the state of the control of the state of the control of the co

(1) The presence of 2 or 3 discrete nuclei in the tip of the tail (2) in having an small pore open further anternorly (3) in several other minor and according to Lichtenstein characteristic differences in length and internal structure

Faust (rozo) examined thick blood smears prepared by Brug and says that the parasite has been so definitely described by Brug as to leave no doubt the family flamide and that the specific characteristic given tod

that it is a distinct spec es probably related to Wuckereric bancrofts. Faust gi es the

following descript on

The larve measure 20 to 800m length by 5 to 6 greatest as b radth. They are mixeted with a sheath wide his very mach longer than the larves. The critical is very delectely strated. The autenor extremely as blandly rounded and bears a double style process. The extra no 200m is a blandly rounded and bears a double style process. The extra no 200m is a blandly rounded and bears a double style process. The extra no 200m is a blandly rounded and bears a double style process. The extra no 200m is a blandly rounded to 200m is a blandly rounded to 200m in the extra notation and port the holdy decrease to an accumulate could extremely. At the extreme could termination there is an elongate mackus and about rop in 6 ont of this nucleus there is an volumeters between two bears of the control of the merchant of the record of the control of the merchant of the control of the merchant of the control of the c

Feng (1936) has studied the developmental stages of the larvae in the mosquito host. He has found that his, Windsterns bonzefit there are 3 true larval stages and 2 cedyses. He regards the G cells of the larvae as not gential cells but believes they are responsible for the formation of the rectum and the anus.

He has also made a comparative study of the anatomy of Microfileric mediyi in inclusive bit in it is a like point out that Microfileric mediyi in inclumily mear to Mic fi e los except for its tail. He agrees that Mic file a mediyy probably belongs to a distinct species but while the adults are found than point cannot be definitely settled.

The following table summanues the differences between Vicrofilarsa ba c ofti Microfila a malays and Mi rofil a los

TABLE OF DIFFERENCES BETWEEN Microfilered Bonce fix Mf Makeys and Mf Loc (Adapted from Fenr 1931)

Creation Feet 19337			
Mf bancrofts	Mf = alay	Mf lo	
r Periodicity usually noc turnal	,	Periodicity diurnal	
2 Le gth 244 to 29ô μ (th ck films)	Length 177 to 230µ (thick films)	Length 250 to 300µ (thick films)	
pore (28 95°°)	(37 07") f r behind et cretory par (30 09")	(356°) to Mf maloys (316°)	
4 G-cells small s in lar size Gr-G far behind G G ₁ 70 4°'	G cells a larger G rela tavely near a d larger than Gr-G4 G1 68 33 7	G-cells similar to Mf moley G 686"	
5 Anal pore 82 48°° 6 Tail tapening to d licate point no terminal nuclei	Tail swollen at levels of a	Anal pore 8 ger Tal t pering gradually caudal suclei continuous	
7 Appearance graceful sweeping curves	secondary kinks	with those of the trunk Appearance similar to Mf malayi	
as well as atrematics	to lymphat c of lower e trem ties	ing of subcut neous ts	
g Intermediate hosts opta mum Culexfal 1 s	Int mediate hosts Mon so a spp Anopheles spp	Int rmedi te hosts Ch y	

Geographical Distribution and Prevalence — This parasite has not only been reported from Malaya and the East Indies, Sumatra Borneo New Gunnea, but also from India especially Travancore, fodo China Ceylon and South China especially in the region of Huchow Lichtenstein and Brug first observed the microfilariae in the Celebes, but point out that it is found sporadically in every part of the Indian archipelago

Brug (1932) pointed out that in the Dutch East Judies Filaria malays is more common than Filaria bancroft: In one locality 47 per cent of the population harborid Microfilaria malays. In Sumatra on one exists: 18 per cent were found infected

Bonne examined 1360 persons at Sockabormi Java and found that 3 harbored between benerofts and 7 Mf malays Kocke also found Mf moleys in Balsone Octos. India.

Iyengar (1932) points out that the type of filtral infection occurring in two could areas in Travancer has been found to differ from that observed in other parts of India While both types of filtral infection occur in Travancore those in the sandy could areas resumble Microfilters melays in faster studies; (1933) he reported in 1931 blood examinations Mf melays was present in 6138 and Mf Beneroffs in 3819 and both paranties in 6.

Dassanayake (1939) in the southern province of Ceylon found 80 per cent of the filterial infections due to Iff molesy and so to Iff boncrofit Poynton (1938) states that infection with If boncrofit in the Federated Valay States is spondic apart from Singapore and that the endemic infection is caused by Iff molesy:

Fing found a case of infection with this parasite in Wenchow Chekiang China and suggests that it may be a common infection in this particular province of Chekiang

Transmission -- Mosquitoes which are Lnown to be intermediate hosts of this filaria include Vansonioides annulatus, V cumulifera Anophilis barbirostris and A hircainis (var sinensis)

With reference to the intermediate host Brug found that more locality where 47 per cent of the population harbored 117 malays Califfratigns was absent in thousands of mosquitoes caught in the house there Maissmoodes annulatus and Mansoniodes annulatus commonest local mosquitoes and the microfilariae occurred practically only in them. They were found naturally infected in r.g. and z.z. per cent. He also found this species acquired experimental infections will 117 malay to the extent of 62 per cent respectively. All the species of Maissmoodes are nocturnal feeders. The Maistmoodes larvae and pupper are found in the water in pady fields in association with Psitia plants on which they depend for air. I Jengar says it is only on the under surface of Psitia leaves that the erges are deposited.

Bonne likewise made attempts to infect Cules futigons with Filana molays but failed in the attempt thus confirming the negative results previously obtained

in the attempt that comming the negative results previously obtained and develop in 800 experimental Culer fairfur but readily did so in Mansons annulifer. In the latter measure to natural infection was found in 26 per cent of over 900 specimens.

The production of the producti

Mansonso des annulspes already known as a possible vector was present in small numbers. A species of Aedes (not identified) could not be artificially infected.

Brug (1932) made further studies in Ialoe Division Celebes and concluded that Anopheles bo b rostris is probably the most important and indeed only carrier in that region. The natural infect on index of this mesogration was 8 is per containing in taining mature larvae. The artifulal infection index was 60 per cent. Development of the larvae in this mesounds was complete in 81% days.

Rodennaldi (1934) in Java Jound Virusamiendes annul fe s was especially infected with this microfilana -730 per cent out of 91 ind viduals. In other regions If annulative long-pairs and uniform sare all found infected. Gallard (2010) also believes

If indicus is concerned in Indo China

Feng (1936) found that complete development in the appropriate mosquito (as for example Anopheles har on it was sinersus) required a

minimum of only 6 days

Pathology—In the Dutch East Index Brug states that Microflaria molaria more often associated with elephantiass of the legs and 3 index eras beneralit with elephantiass to the legs and 3 index eras beneralit with elephantiass of the genutals—Eighty per cent of the midected individuals in one estate in Sumarias suffered with elephantiass. Honever in other parts of the world it is clear that 31 beneralits is the sences most frequently associated with elephantias is of the less.

Korke in India also states that MT midsy appears to be associated with the areas where elephantiasis of the lower extremities in present while II framorfits seems to prevail particularly in the regions where hydrocele is common. Lyengar found the genutal organs rarely infected but elechantiasis was seem as child of 6 version services.

Galliard (1940) in a study of Mf moless in the blood during 24 hour periods observed that the maximum and minimum numbers that were found on different occasions at different hours and the total numbers

at these same hours were quite variable

as these same nours were quite variance.

Mansonindes mosquitoes are peculiar in that the aquatic stages develop under water the larvae and pupes obtaining air by piercing the roots of Poist, (mater lettuce) plants, less often other aquatic plants. It-magar has found that the indertion can be controlled by destruction of the Pistin plants in ponds and swamps. Sweet and Pilla have also reported successful results in the elimination of the infection in North Travancore by destroying Pistin and Mansoninder.

Dipetalonemiasis (Acanthocheilonemiasis)

Definition - An infection due to Dipetalonema persians disseminated in Africa by Culicoides austens

Geographical Di tribution and Providence—"The shallt private as a factored by Denoth to Denote in Denote i

1226

inhabitants infected 55 7 per cent of infection in the women and 47 per cent in the mea 45 per cent of the children in arms were also found infected Cases have also been found in Alzers and Tunis

On the west coast in the forest portions of the Cameroons Sharp has found selles than 92 per can of the inhabitant snefected. In west Gabon Gallard found a wise prevalence particularly in the native women and children 4,8 8 per cent being infected. The degree of infectation however varied greatly in the secred distincts. In certain parts of the forest the women and children seemed to be immune while in other parts the blood in 100 per cent showed the microfilaria. As a rule children between fix each wheels of the control of the control of the secretary cars of infection an Africa in an add vanid the basin of the Congo. The guild and chinquistic ear encountered in some of these regions and Ziemann and Rochenov and Renchenov that Secretary are recorded the finding of this Jibrory control also from other areas outside of Africa especially in earlier years in British Guana side little according to Maison Bahar probably in New Guines. It has also been reported from South America in Venezuela Transida throughout the lower stretches of the Amster Auler and Cameron and Venezuela Transida throughout the lower stretches of the Amster Auler and Cameron and Venezuela. Transida throughout the lower stretches of the Amster Auler and Cameron and Cameron in Venezuela. Transida throughout the lower stretches of the Amster Auler and Cameron and Cameron in Venezuela. Transida throughout the lower stretches of the Amster Auler and Cameron and Cameron in Venezuela. Transida throughout the lower stretches of the Amster Auler and Cameron and Cameron in Venezuela. Transida throughout the lower stretches of the Amster Auler and Cameron and Cameron in Venezuela. Transida throughout the lower stretches of the Amster Auler and Cameron and Cameron in Venezuela. Transida throughout the lower stretches of the Amster Auler and Cameron and Cameron in Venezuela. Transida throughout the lower stretches of the Amster Auler and Cameron and C

of British Guiana where the adult worm was first found.

It has frequently been encountered in the blood of Europeans who have resided in central Africa, where it is sometimes found in association with Microfilaria los and Microfilaria bancrofit and in South America with Viscoplaria o ards in the same

individual

Sharp points out that in west Africa, Filoria persions while common in the natives must be regarded as one of the rarer parasites of the white man which he attributes to the fact that the latter invariably uses a mosquito net at night which is the only time the transmitting agent

(Culicoides) bites

Description of Parasite —Dipetalonema perstans (Manson 1891 Noke and Maplestone 1935) (syn Acoulhochelonema perstans (Manson 1891) and Ranliet Henry and Langeron 1912) is classified by Yorke and Maple stone in the subfamily Strakning and in the genus Dipetalonema Diesing 1867, in which the mouth is bounded by lateral epubliet like structures the spicules are unequal and the vulka is in the desophageal region

The adult worms are failtorm tapering toward each extremity especially Not tenority. Near the tip of the tain in each set there is laterally a paid short tenority processes giving the end of the fail a trifid appearance. The male is smaller than the state of the st

The microfilariae observe no periodicity being present in the blood both by day and by night the numbers at different times often varying considerably. Manson Bahr points out that their special seat of selection is not in the peripheral blood but that of the heart lungs norts and other large vessels They have not been observed in the sphem and only in rare cases in the liver and parties. In the blood the long forms of the microfilance sometimes measure as high as 200 in illength by 4 3s in width. They possess in a remarkable degree the power to clongate and to shorten them. lives so that both long and short forms (the latter pre-dominating from 90 to 110 in length and 4s in breadth) have been recognized.

Microfileria fertisati is in any ca e much smaller than the microfilaria of 8 uchereria bancrofts or of Los Ios and is further distinguished by the entire absence of a sheath and by the character of its caudal end which is invariably truncated and abruptly rounded off The V spot is about to a four from the cephalic extensity. There is no marked tail spot and no red staining granular miss can be demonstrated. It also has a freer and wider motility than the sheathed microfilaria.

Pathology -The adult parasites have been found particularly in the serious cavities the mesentery and in the perirenal and retroperitoneal

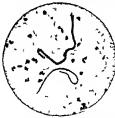


Fig 304-L o ab ve As nih k l ma persi s b low (From G een fter Fulleborn)

connective tissues and in the pericardial and pleural cavities where they are sometimes found in considerable numbers. Manson Babr states that Chesterman has discovered an adult female in a small cyst over lying the brachal artery. Brumpt has reported finding angle parasites in the tissues which apparently cassed no reaction about them. Rodhan (1937) in one case found the adult parasites under the capsules of the kidney. Num rous innestigators have attributed no pathologic significance to infection with Dipelalomens persions largely on account of the fact that many individuals who harbor the incrofilaries of this parasite in the blood manifested at the time no evidence of classas. How ever many cases of infection with Buckerens banceofit exhibit no evidence of disease.

In wild animals other species of Sets a found in the abdominal cavity are frequently calcified when they may goe use to moderate raffaramatory reactions and to some

addrasions. Faust (1937) states that in a related species. A practic found in \epsilon World monkeys the worms characteristically see themselves into the mesuitry epiphodo pleural lining and pericardium where they act up considerable local unitation with an accompanying fibrinous resultate.

In the past few years there has been an increased amount of evidence relating to the disturbances caused by Diptalionems. Sharp who has had a very wide experience states that it is impossible to absolve this nematode from blame as a pathogenic parasite since there are just as good grounds for assigning to it a share in the production of lymphatic varices of the groun as there are grounds for designating if unknerna banarofit as the sole cause of elephantiasis.

Braun and Siefert associate infection with this parasite with orders raisbur and ings and abscesses. They also state that it may provoke feverals long affections and believe that massive infections induce a condition similar to alexing suchness.

Chambon has noted in a case of sleeping sickness the presence of sleeping pertor in the cerebrospinal fluid in association with typanosomes. The microfibure metals present in the perspheral blood and in jumph from the cyticchlear gland but not the typanosome. He concludes that the meninger were so altered probably through the action of the typanosome that true forward results of permitting the partiage of the incredibing from the circulating blood into the subarschinned space.

Rodhain has likewise reported calabar swellings or ery appelatous sailing of the feet which disappeared on rest in connection with Dipetationness perstant. Fulleborn also attributes the occurrence of calabar swellings to this parasite and mentions the observations by Marshall concerning the association of oedema in the extremities and other parts of the body resembling calabar swellings as being due to Dipetationema pritarion for the gall bladder may be attributed to its presence and that it may form occasionally subcutaneous cysts

Morenas has reported a case in which there was tonic ordema of the left tyrild dyspinear precordial pain and a 50 per cent cosmophilis which was attributed to the infection

Moher (1939) believes the parasite may in some instances give rus to febrile disturbances (33-35 C) since in some cases the fever could be attributed to no other cause as it disappeared as did the marcollarise from the blood after intravenosi impections of a per cent methylene blue (desses of 3-10 cc)

Transmission —Partial development of the parasite had previously been observed in several species of mosquitoes but none of these could be regarded as true intermediary hosts. The true life history was first demonstrated by Sharp in Culicoides auxiens in experiments carried out in the British Cameroons.

If this midge is allowed to hate a main having microfilariae of Dipetelonium printing in the blood, the larvae by the end of 6 hours have passed out of the stomach and are found bying either in the stomach wall stell for in the fait body of the aniest. They end for muscles of the thorax in about to play hours after ingestion, and after undergoing further development they pass to the passed and end of the day by the 7th day, the cycle in the 9th wall occupying from 2p days. Eventually the infective form appears the proboscus of the fit when it has increased to a time its sequential length. The natural larvae except from the proboscus by stretching and finally bursting the terminal near

branous portion of the laboum. Seven per cent of the wild 8 es were found to be indected in the region where the experiments were conducted owner op per cent of the natives were infected with the parasite. Only the female bets man. It is a deter much a glib to the bad exhibits not a classys essential fort to both. Sharp believes that Culton 4 x about will also prove to be a minual curren of this parasite. Some species of Cultonials is whee been reported by sometimes these set don't.

Diagnosis —Diagnosis depends upon finding the un-heathed mucro filaria in the peripheral blood. The parasite must especially be different ated from Do. arks. In D. perstant, the larvae are usually small and the nuclei extend to the tip of the tail. while in o. ards the nuclei do not extend into the tip of the caudle extremity.

Rodhan and Dubois have applied the intradermat resection in 3 cases of Depletioners persons infection. The expection of the Droffic is a minute artigine of Entity was made to the skin of the activers surface of the forearm. The 3 patients infected with Depl. I learner presidence were and to exact in a typical manner with the appearance of a detrail papille 2 to 3 cm in chameter followed by a subcutanous swelling. In 3 of the cases the swelling persisted for more than 2 hours and involved the whole of the cases. They conclude that the interferral secretion is applicable to infection with infection with all members of the family of the First
Treatment —The treatment for any pathologic conditions produced by Dipetalanema perstant is discussed under the treatment of filanasis due to Wucherers ban roft: and under Loiasis

P obbless:—bo effects e control messaves have been discovered. The unified solid Cubined to rapidly pass though it mesh sevening and monquion netting here only mosquion nets with extremely fire mesh are protective at might. The midgan often bite in swarms usually at dust. More commonly they bite only in distinse and priction may often be obtained by having a light near while sleeping breasth the net. The year often found beceding in deep lakes and some species in salt water.

MANSONELLA OZZARDI

Dipetalonema ozzardi (Manson 1897 Faust 1919) Synonymo—F la 10 oz.ard Manson 1897 Feloria dema quaye Manson 1897 (ne. Zune 1892) F et juncee Railliet 1918 F laria tukumona Bigheri and Azaoz 1917 Mansorella o ro di Faust 929

W o ards is known to occur only in the western hemisphere in parts of Central and South America and the West Indies

Faust (239) has created a new genus. Hanse ella for this parasite and classifies the genus as a member of the subfamily Startagersa; it is the chara to a 1 th subfamily but distinguished by the piecene, of paired fieling flaps late at to the cuadia estimity of the a full female wo m and by unsheathed moveofilariae with pointed tails lacking a nuclear o e for the terminal 2 to 6 row.

The microflature of this paras to were first studied by Manson in blood obts and by Dazard from Carlo I do any from the interior of Birt is Guinas. The microflature as at first believed to be different from that obtained by Newson from the native and is vicent Birt with West Indies when was designated by Manson (1897), as $M_{\rm F} c = M_{\rm

1340 FILARIASIS

The common macroflans of northern Argentine was first described by Righm and Araoz. Both these authors and Padilla (1913) considered it a new species. Maniferia furumana Later Rosenbusch and Musilers (1932) pointed out its restablanc to M demorgance and Fullebora who has made a careful study of the material from

Argentina found no morphologic differences between 111 fucumons and 111 d moreant Geographical Distribution. -- The distribution of this species in the western home sphere includes British Guiana Colombia (Balfour 1027) and in the British Rest Indies St. Vincent St. Lucia (Galgey 1800) and Dominica (Low 1902) Dutch Guans (Bonne 1920) northern Argentine (trans and Bighest 1914 Bolivis (Muhlens 1975 and 1932 Vogel 1927) Yucatan (Hoffman 1930) Puerto Rico (Hoffman 1930) Panama (Clark 1930 VicCoy 1933) northern South America Venezutia (Rount The species has been found to be exceedingly common in certain regions of (2201 South America In the Province of Tucuman (Argentina) 50 6 per cent of the inhabit tants were found infected and in the Province of Jejuy 39 1 per cent (Muhlens 193) Padilla found the rate of injection in sorre instances to sary between 16 and 25 per cent McCoy (1933) found that the blood of 44 5 per cent of 110 Indians examined a Dares Province Fanama contained this parasite. The infection rate in native villages in the same region varied from a to 57 per cent and averaged 9 9 per cent in the 244 batters examined Although this species was reported by Manson and by Seligmann as occur ring in New Gurnea, it seems now possible that the species may be instead Martel. "" male; which has been especially encountered in the Celibes

The Parasite - The adult females of Manoncia o and have been studied by Galgey Daniels Low and Oztard The adults have apparently not yet been recovered

from any of the cases in northern Argentine

The adult male is known only from a single posterior tragment of 38 mm. The tall is strongly recurred and becomes gradually narrowed up to 0 27 mm from the up

is attengly returned and becomes gradually nationed up to n 2;

The tenule worm has a length of 5 to 8 x mm and x maximum breadth of a x to a x mm. The cutucule is smooth the head is unarmed. The small mouth lead directly into the nesophagua. The anal opening is on the summet of a small spinle on 2 x mm from the posterior extremity. One white side of the caudial extremity there is one pair of lispects with a fleshy core. The valva is intuited a yr to 0 ft one from microfilariae are unsheathed and are very active in fresh blood films. They of such mailer than M beneficial and are very active in fresh blood films. They of such a ready of the control of the fresh are than the control by a sharp point of the thready at the dy. Ulwaliy they measure about not by a. The latent of the tarrows are the dy. Ulwaliy they measure about not by a. The latent of the tarrows are the dy. Ulwaliy they measure about not by a. The latent of the tarrows are the dy. Ulwaliy they measure about not by the first high of the larva is given by verif as follows:

	Per Cent
Beginning of the first head nucles	7 S
Nerve mag	21.9
Excretory pore	31 \$
Excretory cell	35 9
G, cell	693
G. cell	44 s
Anal pore	79 4
End of the last tail nucles	95 0

McCoy found that the microfilariae observed by him in Panama in 1933 corre aponded in general to these morphologic details given by logel. M or and it said to observe no periodicity

Transmitted—Low found some development stages of H e of its Acids stylls. Dave 1, 620 He it 17 monators on a carter of H e of its Acids stylls. Dave 1, 620 He its 17 monators on a carter of H e of its Inspection Of these a west found infected (a Anaph he is a semiculatur 1 Anapholes substitutes and it Aldie says). In each case the thorne muscles were movined. The head and problems were not invaded. He thought that Anaph is surremovables and possibly Anaphole substitutes mught be the responsible transmitter. Owing to the left that the diament

LOTASTS 1341

prevails in wooded areas near streams particularly in the foothill country he suggests that a further study should be made of other insects especially of Sim lium

Buckley (1934) working in St. Vincent. British West Indies has conclusively demonstrated the development of $F \circ ard$; in the sand fly Calicoides furent Poey. Two hundred sand flies collected in the vicinity were given an infertive feed of blood of $F \circ ard$; carriers

Of these files 27 5 per ceast were subsequently found to be infected with developing stages of the private. The negated my not hance magnated within twently four hours to the thorax where the entire morphologic development takes place. In files which were kept alive for 7 or 8 days advanced stages were found in the thorax and head and their emergence from the proble cs was induced by hight pressure on the bead Five per cent of Chilastics for one cought in the vicinity were found to be naturally infected with developing larvae.

Pathology —Daniels (1899) found the adult prinsistes at the autopsy of 2 Demetara Indians. They were situated in the mesentery and the visceral lat. Later Galgey found 5 adult females in the omental tissues of a native of St. Lucia. As is generally the case with other species of Scarimae found in animals the adult parasite give rist on opathologic lenons except when they become cretified when slight inflammatory changes may occur about them. The worms generally are regarded as non pathogenic.

Multies (1917) states that while in ge end induction indicted with these in the finite in Argentine were generally without manife it discally imploin nevertheless mist of a recommendation of the properties of the indiction is consistent of the infect on It was however difficult for Yulkiens to integree these signs in we of the fact that the most duals usually softer with malance analysistenses or etc en perhitti. Multimate also states that the infective cases occurred almost exclusively aim on the porter classes who layer in miserable banks in wooded areas of the country.

MicCoy in Panama states that none of the ind viduals infected showed any obvious

symptoms which could be ascribed to the filarial infection

Loiasis

Definition.—Lona is is a form of filariasis caused by Los los the para site frequently produces no symptoms of disease but in other instances gives rise to inflammatory processes and to fugitive swellings of the skin probably of altergic origin (catabar swellings). It is transmitted by

Crysops dimidiate and C silecte
Geographical Distribution—Los los (Filaria los Filaria oculi Filaria
diurna) is widely distributed in west and central Afria and particularly

along the Congo River and its tributari s

It is found on the west count from herra Leone to Benguella confined mostly to the toustail plans and the deleta re, on it is especially e.m. in the Cammonn Call bar and along it may be goove Bi er where a very high rate of infection has been found Brumpt (in a) find 5 per cent of the whals that along the Welle River in fected Low rem riced th 1t is no exaggeration to say that if European sende for more than 5 years in the reg. no 5 langiars and 5 lain the Hard Welle Province and Bamb's in the Burth Trovince in central Africa they a certa a to become i fected. Woodman and Bokkhar (vold) reports 5 (the population of the Anglo Fergitum Softan infected

PTLAKIASIS 1340

The common microfilaria of northern Argentine was first described by figure Araoz Both these authors and I adilla (1935) considered it a new species, New York Later Rosenlusch and Muhlens (1932) pointed out its requisite b M demorquays and Fulleborn who has made a careful study of the externibe Argentina found no morphologic differences between Mf lucumons and Mf herman

Geographical Distribution. - The distribution of this species in the series bea sphere ircludes British Guiana Colombia (Balfour 1921) and in the Emal An Indies St Vincent St Lucia (Galgey 1899) and Dominica (Low 1901) Duch Cars (Borne 1920) northern Argentine (Arabe and Pigliert 1914 Lobius (M.Lect.) and 1932 Too 1 1927) Incatan (Hoffman 1930) Puerto Rico (Hofman in l'anama (Clark 1930 McCo) 1933) northern South America Vertrea (600 1935) The species has been found to be exceedingly common in critin species South America In the Province of Turuman (Argentina) 50 6 per cent of the share tants were found infected and so the I rosince of Jejay 39 1 per cent (M. ben, Padilla found the rate of infection in some instances to vary between roand specifi MeCoy (1933) found that the blood of 44 5 per cent of 119 Indians exampled in De-Frounce I anarra contained this parasite. The infection rate in taking rating same region varied from a to 52 per cent and averaged 9 9 per cent in the 241 into examined Although this species was reported by Manson and by Selimants or ring in New Guinea it seems now possible that the species may be invited its

moleys which has been especially encountered in the Celiber The Parasite -The adult females of Manioncha orards have been relative talgey Daniels Low and Orrard The adults have apparently not jet bera more

from any of the cases in porthern Argentine

The adult male is known only from a single posterior fragment of 18 mm. Then is strongly recurved and becomes gradually narrowed up to 0 27 mm. fon Lab

where it abruptly rounds of into a slightly bulbous termination.

The fermale worm has a length of 65 to 85 mm and a manmum brudth of 5 The cuticula is smooth the head is unarmed. The small more in directly in to the orsophagus The anal opening is on the summit of a small proo 25 mm from the posterior extremity On either side of the candal extramy the is one pair of lappets with a firshy core The vulta is airuated a 71 too "ins to the antenot end of the female worm The small oval eggs measure 31 X 34 p microfilance are unsheathed and are very active in fresh blood films. They are smaller than M barceeft and are characterized by a sharp pointed tail fee it is at the tip Usually they measure about 300 by a sharp pointed to are points of identification of the receiptions of identification of the receiption of the receiptin of the receiption of the receiption of the receiption of the re points of identification in selation to the total body length of the lart a press Logel as follows

el as follows		Per Cent
		5
	Beginning of the first head nucles	21 9
	Nerve ring	51.5
	Exerctory pore	35 P
	Exerctory cell	5g 3
	G: celi	g #
	Ge cell	9.4
	Anai pore	o5 s
	End of the last tail purler	n 10 1953 ⁽²⁾
		15 5255

McCoy found that the sucrofilance observed by him in Panama in 1935 or sponded to general to these morphologic details given by logel. If rain's next observe no periodicity

Transmission.—Low found some development stages of If amount to hid stages with the control of t d) an Argentine Cities olbitary a 1110 Davis (1928) fed 117 mosquitoes on a cattier of 3! 4 were found injected (2 Anopheles to a maculate actypii) In each case the thorac muscles w

were not invaded. He thought that Anotheles

albitarris might be the responsible

prevails in wooded areas near streams particul rly in the footbill country, he suggests that a further study should be made of other insect—est eccally of Simulium.

Buckley (1934) working in St. Vincent. British West Indies has conclusively demonstrated the development of $\ell = ard_1$ in the sand fig. Culcodes furens Pocy. Two hundred sand flues collected in the vicinity were exten an infective feed of blood of $\ell = ard_1$ earners

Of these fies 23 5 per cent were subsequently found to be mixeted with developing stages of the part in F. the negletical mixerification is practice within investy four hours to the thorax where the entire morph logic development takes place. In five which were kept alive for 7 or 8 days advanced stages were found in the thorax and head and their energence from the problems was induced by 1ght pressure on the head and their energence from the problems was induced by 1ght pressure on the head and their energence from the problems and the comply were found to be naturally discretely with development larges.

Pathology —Damels (1890) found the adult parasites at the autorsy of a Democrat Indians. They were stuated in the mesentery and the viceral fatt. Later Galgey found a dutte females in the omental tissues of a native of St Lucia. As in generally the case with other species of Statamase found in animals the adult parasites give rise to no pathologic elsions except when they become cretified when slight indiammatory changes may occur about them. The worms generally are regarded as non pathorem.

Multiless (1912) states that a life in general individual indicted with these matro filants in Augmenta were generally attent manifest the cal symptoms invertedates most better than the state of the state of the state of the state of the plates. Peres regarded this condition as characteristic of the indiction. It was however difficult for Julie's a to interpret these signs to view of the fact that the individuals usually suffer a lim nation or analyticious size or view of the fact that the individuals usually suffer a lim nation or analyticious size or view of the size that the individuals usually suffer a lim nation or analyticious size or view of the poorer clauses who better that the size of the size o

Mic Over in in sections spaces in wooder a test of it country

Mic Coy in Panama states that none of the individuals infected showed any obvious symptoms which could be ascribed to it e filtral infection

Louisis

Definition—Losass is a form of filanam caused by Los low the para site frequently produces no symptoms of the ac but in other instances gives rise to inflammatory processes and to lightic swellings of the Lin probably of allergic origin (calabar swellings). It is transmitted by Cryosic dimedical and C sidaca

Geographical Distribution—I of los (Filaria los Filaria oculi Filaria diurna) is widely distributed in west and central Africa and particularly along the Congo Liver and its tributanes

It is found on the west coast from 'werra Lone to Brogaella confined mostly to the control plan of the delta regions. It is especially common in the Camero is Cali be a and along the Grown River is were a wery high rate of infection has been found Rimpin (i.e.) I found it per cred to the malastimate shough the Volle River is retrieved to Low tensate dit at it is no exageration to say the 1st Properary a de for more than years in the regions of Vanagera and X has the Blanck Weller Fronces and Blanch in the futurb Province in central Africa they are certain to become infected. Woodman and & blanc (color irreport styrig of the population of the Appl Exyrit is Oxidian infected.)

1342 LOIASIS

History—Led loa was early known as the eye norm of Africa its occurrence was perhaps observed and first pictorially represented by Pigafetta during his travels along the Congo River in 1508. The enhet record of the removal of the parasite was that of Mongia (1770) who extracted it from between the conjunctiva and albuginess of a Negress at Santo Domingo Haiti.

Shortly afterwards a number of other cases were reported from French Gunas banto Domingo and Brazid all bowners in accently imported West Africas slave. The first report of the paraset in Africa was by Gungo (19, 8) is Angola where infection was found to be common and the parasets described under the native term by a the United States cases have been reported forumate.



Tio 303 -- L los in the sub cutaneous tissu s ta ce normal s ze (After Fulleborn)

to time. Used who collected from the literature of cases of infections also studied cases occurring into country up to a god and wrote an excellent monograph upon the subject. Smith and Ratus (1914) admitted to the control of the c

Etiology —Apparentis all races are sur ceptible Adults are more commonly found infected than children Males and females appear to be almost equally infected

Description of Parasité —Los los (Guyot 17;8) is classified in the subfamily of Losance (tork and Maplestone 1996) and in the genus Los Stiles 1996 in which genus the specules are unequal and distinuish Los loss is the type species

The adult male measures about 30 to 3 mm in length and 5 3 to 4 mm in greated thickness. The fermal is about 50 to 60 mm in length and a sammain breath of 0 mm. Here it is shorted to 40 mm.

dutrual periodicity
Metrofilaria foa (Fig. 504) is very samilar in aute to Afterofilaria benereffi messurins
on an average of about 1909 in length by 7 50 in width and hitemise enclosed within a
shoath. Its tail is populed and it has similar V-shaped and tail spots. Certain points

of differentiation have been described in tained preparations of both living a d-fixed parts tes especially by Sharp and by Filliborn. It stained preparations the larvae can usually be distinguished by the fact that in Los los they show a significant view and an acute bond at the tail. Another p int suggested for different time in the character of the estimate of nuclei which in Microfilors los reaches to the top of the tail a d-is supported to the stail of the significant instanced specimens as a hollow viscus with a chromaten staining body on its outer side. The notice of its cutticals realls can easily be distinguished when stained with diduct Genus solution whereas in Microfilors bone off they are never seen discretely MI los bowers or er exhibit the real granulus mass (Ipectiforpic) of I like in seen as a series of a scete nuclei on a bits independent in MI fount of it into been nutrit visit at a large with new loss of the seen as a series of a scete nuclei on a bits lossely lossely absorption is much slower and the stain shows an affinity for the exercisory position absorption is much slower and the stain shows an affinity for the exercisory position and the stain shows an affinity for the exercisory position and some content of the seed of the sifter a baserofix absorption is much slower and the stain shows an affinity for the exercisory position.

Transmission—Manson (1895) called attention to the mango fly Chrysp's dimitiela as a possible intermediary on account of its durnal and blood sucking habits and local distribution. Leiper in 1973 in Nigeria first carried out experiments with C dimitielas and C sile as and observed divelopmental changes of the parasite in the sile and involve ment of the silivary glands. Al ine (1915) in the Cameroons examined 500 Crysp's dimitiela and 100 C silectes and found that 2 s(per cent) were infected and that on (1 s per cent) the lars are were fully matured.

The more complete life cycle of Los los was elucidated by Connal and Connal in Nigeria in 1021-22

They also found there fire naturally infected with microfilance. Later they source ded in infecting wild files of these two specess (Crypte) of miles and C. lisses) with the microfilance of Loss lee from man. The developm at of the microfilance in the fly is similar in many respects to that of there if is to be crofil in the migrot after the detailed of the microfilance in the sea and flat body the larvae migrate to arise the head where the matter one measuring about a min nile gibb yet ja in breadth are found in largest numbers about the train day. When they are ready to leve the fly at the time that it thies they make their way through the laboum. Not of I he mature larvae leave the fly on about the train by Withough the laboum. Not of I he mature larvae leave the fly on about the train by Withough the laboum Not of I have a suppressed under the sin it is as demonstrated have minged from the fly they have disappeared under the sin it is as demonstrated by a supplied of the control of the contro

In connection with the fact that the microfilarize of Los los are found in the peripheral circulation of man usually only during the day it may be of interest to recall that Chrysops is a strictly durinal biter From sourise until 10 or 11 am and from 4 pm until dark are the periods when the 60 vs most numerous and active It seldom bites in bright sunlight preferring the shade of the trees and the shelter of the variand. Only the female bitest and transmist the disease in man

The development of the parasite in human beings is apparently usually very slow. In a numb r of cases the presence of the parasite was not discovered until 3 or a years after the individual had left the endemic area.

LOLASIS 1344

Hauer (1932) reports one instance in which the first skin symptoms sug gestive of Loa infection occurred 3 years after he first reached and 1)2 months after he finally left an endemic area. The shortest period on record is apparently one reported by Elliot who noticed the presente of the parasite in and about the eyes within a year of the arrival of the individual in an endemic center of infection

In 2 cases a parasite was extracted from the eye 9 and 13 years respectively after the patients had left iffice. In another case the norms appeared at intervals during 15 years. In an anstance reported by knake where infection was acquired in the Cameroons and in which A persians was also present infection persisted in Germany from 1915 to 1930 Laveran suggested that the life span of Los los was 14 years Manson Bahr reports a case m which all signs of the adult worms and traces of the

microfilariae had disappeared after a dera tion of 17 years

Another fact suggestive of the slow growth of the parasite is that while the immature active worms are sometimes seed beneath the skin in children the microflenie are rarely found except in adults and in ont case not for 7 years from the supposed time of the original infection

With reference to this point Manson Babr has reported a case in a British officer in which calabat swellings were first poted in 1916 in Africa He returned to England in 1917 An adult filaria appeared in the left eye in 1919 The blood was repeatedly examined for imcrofilariae during the sub sequent years with negative results la 1922 microfilatiae were found for the first time Therefore in this case an interest

of 616 years clapsed before the appearance Manson Bahr however does not suggest that such a long period elapsed before the adult norms attained maturity but that the embryos had for some reason been presented from entering the blood stream



of the larvae in the peripheral blood

Pathology -The habits of Log log are quite different from those of Il uchereria boncrofti Not only do the Microfilaria log occur in the blood in the day time rather than at night but the adults instead of remaining in one locality and blocking the lymphatics usually circulate about the connective tissue and appear beneath the skin in various parts of the body Also Los los is more especially a parasite of connective tissue rather than of the lymphatic glands The adult worms have been found par ticularly in the connective tissue in many different parts of the body, as for example the subcutaneous tissue often under the muscular aponeurous of the extensor surface of the arms legs fingers and trunk and on the surface of the organs in the mesentery under the parietal peritoneum and pericardium sometimes about the genital organs. They have also been found encysted in the heart muscle and in the anterior chamber of the eye under the ocular and palpebral conjunctiva over the bridge of the nose and in the frenum of the tongue Brumpt found in one necrops; in the tissue of the heart 5 adult parasites 4 of which were dead and cretified and one of which was living

Klotz has described the pathologic changes which may result from the presence of Microfilaria log as observed in the spleen of two African Microfilaria loa was found in the blood of one before death On section the spleens were studied with pin point yellowish nodules Histologically there was a diffuse fibrosis becoming denser in some areas The malpighian hodies were small and many had apparently disappeared the lymphocytes being sparce and largely replaced by endothelial cells with fibrosis along the sinus walls. In other areas the whole splenic architecture was obliterated by nodular masses of fibrosis in which eosinophils were the predominant wandering cells. Remnants of the sinuses could still be traced through these fibrosed areas and within these blood channels many well stained Microfileria loa were encountered About groups of these microfilariae an inflammatory reaction and fibrosis were present. Klotz suggests that these reactions in the spleen may be analogous to the pathologic condition which occurs in chronic calabar swellings He emphasized (in connection with his study of other cases infected with Log log) that it is evident that the temporary resting of the microfilariae within the visceral capillaries is unaccompanied by tissue reaction while a more permanent abode of them as seen in the spleen is associated with inflammation and fibrosis

The production of inflammatory processes the oedema the cyst like swellings and the transient tumors which result during the course of infection are discussed under the clinical features (see below)

Clinical Features and Symptoms —During life the filaria may some times be noticed beneath the skin of the fingers or in different parts of the trunk. Sometimes is seeks soft toose skin as of the breast the lingual frenum the region of the epidotis the skin of the pens the eyelide and conjunctivate and the antenor chamber of the eye. Clesterman in Yakuwa Africa reports finding live adult worms in to per cant of the cases he operated on for herma elephantiasis, etc. Parasites were particularly found in the ingiumal scrotal regions. In one case he found 40 living worms around the cord. From the frequency that the worm has been observed in the region of the eye it would appear that the parasite has a special predilection for that region. However Brumpt points out that the did not see the worm once in the eye in the hundreds of Los loc cases examined by him. Worms are also very common in the region of the nose.

The adult parasites seem to be sensitive to different temperatures and are often attracted to the surface of the body by the warmh of a fire or by fomentations applied to the skin and on exposure to cold the worm may pass into the depth of the eveball. When the parasite appears under the conjunctivae it may cause a considerable amount of irritation and conjection also great pain and swelling in the this gying rise to redness and at times lacrimation. Also pain and swelling in the check may accompany the movements of the parasite near the eye. The

1346 LOIASIS

combination of itching pain and irritation caused by the movement of the parasite under the conjunctiva is described as simply maddening by Elliot in his book on Tropical Opthatmology However, almost instant relief is obtained when the parasite moves into the deeper tisses In an instance reported by him with the parasite in the region of the car the patient suffered on a number of occasions from an intense neuralizabehind below and in front of the ear. This was accompanied by great hyperesthesia of the superjacent skin. Great pain is also sometimes experienced by the presence of the worm in the region of the posterod



Fig 307 —Photom crogs ph of section of cyst c tumor produce d by Lou lou (Harvard
African Exped tion—1930)

urethra and neck of the bladder Serious consequences might result from its appearance in the region of the tima glottidis or in the urethra Frequently the migrations of the adult parasites give rise to no serious

inconvenience though in their progress beneath the skin they may cause creeping and prickling sensations itching and sometimes oedematous swellings in various parts of the body known as calabar swellings

Calbar Swellings—These are transient tumors usually about the day of a small hen s egg. They originate suddenly sometimes preceded by sharp pains and may remain for about three days before disappearing slowly. They occasionally may last for a week or longer. Sharp epoints one instance of their persisting for 6r days. They may occur subcutane ously in any part of the body. Frequently they are seen about the wrist or arm. As many as balf a dozen may appear in the course of a month

The swelling may be painful or painless. The skin over it often itches At times the swelling has been noted to move its position to the extent of several inche an hour. The transcent tumors do not suppurate. Usually an cosmophila is present sometimes as high as 50 to 70 per cent. Micro finariae are often absent from the blood hui they may be observed in scrum withdrawn from the area of the swelling. When the swellings repeatedly recur on the arm or leg they may give ruse to permanent 6,31 tiles swellings (chronic calabor swellings) which have been described by Low and Manson Bahr. Manson Bahr hanson that in such instances there is industation of the fascia and of the connective tissue in the vicinity of the tendon sheaths which may cawe pain on muscular movement. Apparently these swellings are attached to the tendon sheaths and muscular apponentions.

In a Congo native the Harvard African Expedition (399) found a small cystic tumor measuring about 5 cm in diameter on the right arm about 5 cm above the elbow. The tumor contained straw colored flux and an adult Los less. Sections of the tumor showed a diatation of a gland bide cavity of which the flores of the surrounding tissue had been pressed as art by the movements. I the parasite and the alonely accumulating flux.

There has been much speculation as to how the transitory calabats swellings are produced. It has been suggested that they may be due to the wanderings of the parasite or to the birth and discharge of a large number of microfilariae from the adult female as puncture of the swellings has sometimes shown numerous microfilariae in the oedematous fluid It was also suggested by Ward that they may originate from some toxic exerction of the parasite. Low Caro and O Connor also emphasized the idea of an association between these swellings and toxin production Fullchorn suggested that they represented evidence of a host reaction to Los antigen an anaphylactic phenomenon Chandler and his collespices (1930) have produced a typical calabat.

Chandler and his colleagues (1930) have produced a typical calabat welling in a patient infected with I on Ioa by the injection of a Dirofilaria antigen

Within so m sites after the spectron there developed a circumscribed red stelly open ordenateus swelling about hall be seed a hera sage, she has not prorestly the same reads of a she sure it covered an orden the spectron of the same street and of a she sure it covered an orden to a sabety 2×6 cm in dament; Γ mm s to sa be superfixed by the same stellar spectron of the same stellar specifical spectron of the same she same stellar specifical spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of a loss spectron of the same she had been smallered by the presence of the same she had

Fullehorn and Son ensels in whe had pre tously failed in producing calabar anell ings by the injection of a Lou antigen in thy succeeded in producing two calabar swell ings in a pair in infected by Lou I a by the intracutaneous inject on into the arm of a Dil first mind cattract

Fairley after a study of skin tests in lorisis was convinced that the calibar swellings es entially trise from a local anaphylactoid reaction involving the cells of the subcutaneous tissues not primarily of the dermis. He suggests that the reaction is analogous in many respects

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to the delayed reactions so frequently met with on injecting saline extracts of helminths into the tissues

Occasional Symptoms -In addition to the atching and pricking sensations and a feeling of tension which the worm sometimes causes when it appears in the subcutaneous tissues the course of the parasite may be marked by an ordematous track in other instances by diffuse orderna of the back of the hands and of the forearms (Meinkof) Redness of the skin has very rarely been noted. Fairley states that a generalized urticana sometimes occurs. Statt reports a case an a physician in which the first symptoms were transient painless swellings about the joints associated with stiffness Various diagnoses such as rheumatism erythema nodosum and angioneurotic ordena were first made in this case Inflammatory swellings nodules both in muscular and connective tissue (Ziemann) and mutiple inframuscular abscesses due to staphylococci or streptococci and even purulent infection of the hip joint (Manson Rahr) may be sometimes found in association with Los los Chesterman in one instance found a definite lymphatic stone in the scrotum of a case of elephantiasis which showed calcined Los tos in the center Woodman and Bokhari (1041) have reported the enlargement of lymph nodes with chronic fibrosis that were believed to be cau ed by Los los in the Sudan They say it was common to find L toa moving about especially among the blood and lymphatic vessels of the cord and three times one was found in a lymphatic VATIT

Diagnosis -- Connal (1934) has studied 115 cases of calabar swelling in individuals resident in Nigeria 30 of whom were Europeans He states that the four signs of infection with Loa loa in the order of their frequency in the 30 Europeans were (1) calabar swellings (2) visits of the worm to the eye (3) outline of the worm beneath the skin and (4) microfilariae in the pempheral blood. Puncture of the swellings sometimes reveals large numbers of microfilariae in the oedematous fluid The eosinophilia is usually marked The microfilariae are diurnal and often most numerous in the peripheral blood about mid day Points of differential diagnosis have already been considered on p 1333 Eosino philia has been emphasized as a help in suggesting diagnosis Hauer (103) found it of assistance in his 2 cases in which the eosinophilia was between 75 and 78 per cent High eosinophilia however may also occur in infections with other FILARIOIDEA as in Dracunculus medinensis

With reference to diagnosis by the cutaneous reaction and complem at deflection test Fairley has found with Disofloria sminites antigen that both these to its were strongly positive in 6 cases of Los los infestation. He admits however that more information must be acquired regarding the specificity of the reaction and it may yet prove that a negative result 1 of more value in excluding filanasis than a positive reac tion is in indicating it While the complement fixation reaction with Dirofilaria immilia antigen he found is almost always strongly positive in Loa los infestation it has yielded di appointing results in a considerable number of sera collected in India from patients showing microfilariae Only 5 nut of 23 cases yielded positive results concluded that Dirofilarsa extract therefore cannot be regarded as a satisfactory

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Treatment -- In cases where the worms reach the surface as for example the conjunctiva they should if possible be removed through a small incision. It is necessary however to seize the parasite securely with forceps before cutting down to it as otherwise the parasite may escape and disappointment is apt to ensue

Elliot points out that the principal difficulty in removing the parasite from the region of the eye ar ses f om the irregularity with which the worm visits the skin surface and the rapidity with which it leaves it when alarmed and d sturbed. The patient may feel it in the neighborhood of the eye and hurry to the surgeon only to find that in the interval it has disappeared. Again he may actually arrive with the parasite under the consunctive or in the lide and yet his baste may be fruitless owing to the parasite moving outckly into the deep tusties as soon as the surgeon attempts an examination. Hence everything that is required for operation must be in readiness. If the worm is seen a solut on of cocam combined with adrenalm should be carefully installed. If the worm attempts to escape it should be seized through the conjunctiva with fixation forceps A salk suture should then be passed under the worm and tied sufficiently tight to prevent its escape. The removal of the parasite is effected by making a an o in the conjunctiva o or the worm and the worm gently muthdrawn with forceps The conjunctiva wound is then closed a suture being inserted if need be. Should the parasite disappear before it can be serred it may often be brought to the surface again by the sid of hot fomen tations. For the intense pain which the parasite sometimes causes in the region of the eye Elliot recommends the instillation of a solution of novocame into the conjunctival sac which brings about a speedy relici of the suffering. If the parasite is under the conjunctive novocume solution abould be used for local anaesthes a

The treatment of calabar swellings consists in the application of cooling lotions to allay the arritation. Chandler Milliken Schuhardt have found that the injection of 2 minims of adrenalin causes the riching that the transfer within one half hour and the turgidity and heat of the calabar stellings to decrease markedly. Manson Bahr recommends for the urticana and pruntus which is sometimes troublesome a to per cent alcoholic solution of heliobron (dibromotannic urea) applied to the skin at night. In a few instances injections of tartar emetic have been reported of value in the treatment of the calabar swellings. Others have recommended intravenous injections of anthiomakine in doses of a cc. of a 6 per cent solution every other day

Los laguireads. - A new species of the genus Los Los inqui e da bas recently been found by Vaplestone (1935) a unfertil sed female F is or being removed by Rish worth from a European resident in Ind a Alaplestone found the parasite clearly unlike F bont fi It resembled L a log in that it has bosses on the cuticle and it is a or t t mes as long 13 to 14 cm in length whereas the adult female Loo is not over 3 or 6 cm Moreover its posterior extremity as sixa she and the anus is subtermina). There were no microfilariae in the bl od hence Manlestone emphas es it cannot be the adult of M refile an aloys

Prevention should consist in protection from the bites of Chrysops flies in the endemic areas. No really successful larvicidal measures against the fly have been developed. Films of kerosene or semi refined fuel oil placed on the surface of pools over which the flies skim are some times destructive

KEY TO FIXABIAL LARVAY

- I Present to peripheral blood A Sheath present
 - r Norturnal pe od city (usually)
 - - a Tail pointed at night no nucles a top Sheath moderately prolonged b youd tail Break in cell 5 # nd I spot 90 irom bead curves Lashing movements Size 300 by 7 54

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Oceasional Symptoms -In addition to the itching and prickling sensations and a feeling of tension which the worm sometimes causes when it appears in the subcutaneous tissues the course of the parasite may be marked by an oedematous track in other instances by diffuse oedema of the back of the hands and of the forearms (Menkof) Redness of the skin has very rarely been noted. Fairley states that a generalized urticaria sometimes occurs Stitt reports a case in a physician in which the first symptoms were transient painless swellings about the joints associated with stiffness Various diagnoses such as rheumatism erythema nodosum and angioneurotic cedema were first made in this case. Inflammatory swellings nodules both in muscular and connective tissue (Ziemann) and mutiple intramuscular abscesses due to staphylococu or streptococci and even purulent infection of the hip joint (Manson Bahr) may be sometimes found in association with Loa los Chesterman in one instance found a definite lymphatic stone in the scrotum of a case of elephantiasis which showed calcined Los los in the center Woodman and Bokhari (1941) have reported the enlargement of lymph nodes with chronic fibrous that were believed to be caused by Los los in the Sudan They say it was common to find L los moving about est enally among the blood and lymphatic vessels of the cord and three times one was found in a lymphatic VATIX

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these observations and reported upon the favorable results obtained by the removal of the tumors. More recently the disease has been staked climically etiologically and pathologically in Central Ame on by Larumbe Hoffmann Ochoterens they riter and others.

Brumpt in 19 g studied paraents material sent to him by Robbe consulting of a comile parasite and fragments of the extremites of the textremites of the statement with the consistency of the parasite and fragments of the extremites of the statement which will be subjected by shoot distribution of the parasite of the statement of

consistent or tree on using marria.

Subsequent work carried or it by Tullehorn (1924 1936) and by Sandground (1933)
in which a la ge number of parasites were study of hos shown that while there may be
considerable variate, or in endowals speciences there are no constant morphological
difference s between the Afric n and the Caustemakon human parasit; a and that hence
from a norphological platopologic in that obtailed homeforeca agreeties ours a distinct species

trom a norphological standpoint in an until the measure activities in a distinct species. Geographical Distribution—In the western hemisphere on choorercassis has been found to on, mate only in rather sharply circumscribed areas in southern Menco and Guatemals. It has been suggested that the disease may stread to the Urited States by indected immerants coming over the

border from Meyroo and that it may later become endemic in this country.

Johnstone and Larsen (1933) have called attention to this da get and have emplas,

seed 1b. In how cans in the semestace cones and exceeding in the United States.

sized th t physicians in the temperate zones and expecially in the United States abould be come acquainted with onchoeverains since a species of the fly that transmits t (Simulian) is we despread in certar localization from their the western states and the disease has shown a defin te tendency toward northern mg attorn

Report ha e been made of the occurrence of two cas as formbotercas van American endenies of the southern United States. However in neither of these has the diagnosis been accurately venried. The writer alter a microscopical study of pathologisal material settl him from one of these cases was unable to confirm the dappo. Is. In the other case reported a a negar from Ala Dama there was entire a bience of any descript on of the prissing published. However as the maintest int of the disaster progress lowly at my be encountered in the United States in andividuals. In his work formedly not material with the control of the prissing of the prissing position of the prissing of the priss

Ca los Fatévez and Martines Barz (person I communic to 944) rep 1 th 1 the d as on the nersons in 1 th Castenala and Newco General Weeks 5 Cumm g D ecto 1 th Pan American 'ant ry B eau thay app 1 th 1 an Inter American Commissis a tota y n'intriber estigat ns garding the disease and its preve tin ni the coult vis

Cases have been diag owed in burope in the past lew years by Müblens a d Nyl us in Hamburg (9,3) Joyeus Sédan and Eamenst I (1996) in Fran e and Marhatz and Appelm us in Belg im (1993). Also Adams (1997) in Liverg of reported a c se of ketait; sof hotbeyes in which there was a high cosmophid a nd in sections of the cornea Onchorerca microfilars were de cowered

In the settern hemisphere the cond tion as he as a known occ is endemocally only in the mountainous regions of Go term is elsevically in the Departments of Chimaltenano Sololas and the northern part of the Department of Excustion or the subsetter of Pack is topic as distinction between two Pack is topic as distinction. As the subsettine of Pack is topic as distinction of the subsettine of Pack is topic as distinction. The subsettine of the

b Tail pointed straight an elongated nucleus in tip Sheath much prolonged beyond the tail No nuclei at anierior end Size 250 by \$10 & in wides

2 Diurnal periodicity

a Tail pointed sharply flexed nuclei coarse extending to tip. Shath moderately prolonged beyond tail. Break in cells 40μ and V-spot 60 to 70μ from head. Irregular sharp flexures. Size 250 to 300 by 7 0μ.

B Sheath absent \o periodicity

- 1 Tail sharp straight nuclei not reaching tip Size 200µ by 5µ If o act.
 2 Tail blunt straight nuclei reaching tip Break in cells 14µ and 5 spot 50µ from head Lashing propres in movements. Size 200µ by 4 to (straible)
- If Present in tymph spaces not in blood (\o sheath no periodicity)
 - 1 Tail sharply pointed end gracefully curved nuclei do not reach tip \ spot 60μ from head Size 300μ hy 8μ 0 colculur
 - 2 Tail blunt end curved like handt of cane containing a single ros of round nuclei which reach the tip Size 200μ by 5μ 1 streptocrea

Onchocerciasis

Definition —The term onchoeverciasis implies a parasitic infection with the nematode Onchoeverca volvalus in which the most characteristic clinical manifestation is the occurrence of subcutaneous nodules or tumor In certain individuals who apparently show special sensitiveness to the presence of the parasities or to the action of their toxins products of metabolism or disintegration secondary disturbances of the skin and even may occur.

In the eyes the lesions sometimes result in disturbances of vision and blindness, and hence in Central America the affection is frequently referred to as the blinding filariol disease and the parasite which causes it as Onthoreca constitutes.

It as Omenoceria caecimiens
The infection is transmitted by at least five species of fixes of the genus
Simultum, Simultum domnosium Simultum aurdiim, (syn Simultum
metallicum) Simultum orderacum Simultum moorei (syn Simultum
collidam) and Simultum nea es which are indigenous to the variou
countries in which the affection occurs

History—The Mincan condition was observed originally by a German medical missionary who found worms in the tumors of to negroes of the Cold Cast Colony Leuchart who examined this material studied and named the parasite in 1893 Flaria volvishis (Onebsecrea tol 418). I trout (1991) observed tha crises in 5 erra Leone and Brumph (1994) found 15 cases in natives in Central Minca Jong the Welle River Later the disease became widely known in Minca and has been studied especially 79 Italichorn in the Cameroons by Rodibato and Hossette in the Belgian Congo by Dyc Sharp in Nigeria by Blacklock in Sictra I cone and by the writer in Liberia and the Religian Congo.

The Mobile first observed thus condition in Gusternals. Upon removin a time from the head of a chald be recovered they condition in Gusternals and in 1900 before the Screek de I in 1905 at a confirence of physicians in Gusternals and in 1900 before the Screek de I shologe Entique Paris be gave a detailed account of the condition and showed that it was caused by a species of I librare. He also emphasized that the nodules about the scale potten were associated with disturbances of the eyes and that these disappeared following remoils of the tumors. He also described in connection with the disease a default and specie type of cryptaghs armyled at le cours. Subsequently I una and Calderon command

Since Sandground has found no constant morphological differences between Ot cho ce ce tool: far and O coccuttens the latter name therefore should be regarded as a synonym though some suggest it may represent a biological race

The merofilariae which are found present in sections of the nodules and of the dermis or conjunctiva and other tissues of the eye are actively motile. Great variations in size may occur. Two types are apparent the smaller forms measure from 150 to 250a the larger forms from 355 to 750a in length and from 6 to 8p in width. They possess no sheath and are not found naturally in the blood. When as might rarely happen one has been seen in a preparation of the blood it probably has escaped from a lymphatic vessel or space punctured in obtaining the specimen. Gopail (1939) in prolonged careful examinations of the blood in cases of the disease in Nyasaland never found the microflaria in the blood. However

disease in Nyasaland never found the fig a thin section of the epidermis of the face or neck or of the conjunctiva of an infected individual is made to raup to 4 to 8 motile microfilariae usually are found and occasionally as many as 50 are observed

In specimens hardened in absolute alcohol and stained with Giernsa s sol tion tha two forms of microfilarize may be some times di tingu shed In the sho te but often shahtly thicker forms there is a more compact arr ugement of the n cle and they take the blue stsin mo e readily than the larger forms Both have a thick nucles free anter rend and a sum 1 free posterior e tremity In the small forms Bl cklock (o 6) found in the African parasite the cephalic clea ares measured from about s to 8µ a d the caudal clear area from 10 to 64 The first break in the column of nucles w s situated at from 2 to 25 per cent of the length In the large forms the cephalic clear area measures from about 7 to 11s and the caudal fr m 13 to 8 The fi st break in the column of nucle from the c phalic e d was at from 2 to 5 per cent of the length



Fig. 35—(1) of this Cud thity fm l lat lv w (2) O at 1 Overn thin fm ut u hw g lld pl fl ments C m a let d d wngs Mgn fit n nd t d by s l t i ffigu (Aft S dg und)

Ochoic ma (930) by vital stanning of the microfibrate of the N can paras to found that starting from the head the non nucle ted position occupied 5 per cent. The total length the pre-nerv us regio 4z the nervous ring 5 y from the head and occupied 6 per cent. The exter or pore was 34 y per cent the calls of Rodenwall of per cent the annal pure oper cent and the underacollumin cented at 94 per cent.

The presence of the microfilaria has also been reported in the lymphatic yands especially the inguisid glands. However the abut parasites have not usually been found in man outside of modules or tumors. Whether the microfilariae are energly found in the deeper tissues and the viscera is still questioned.

It does not occur at lower altitudes in Custemala and it is especially connected with the coffee production the best coffee being produced in the ne repoin and at these altitudes. It is in connection with the production of coffee that the publishmant ser-specially brought into contact with the flust that tran mit the di case and these fine in Gustemala and Vetuco do not breed below some 2000 feet. In Gustemala in the different coffee plantations from 40 to 60 per cent of the mabiliarity were found infected.

Min in Guatemals, (1936) found to a survey of 173 till figs or from in the hard of 44 at protons were examined that 50 per cent were infected and reported that in La Granja approximately respected the tinking sace infected and Millens and Hoffmann noted that in 190-27 the beforehom the rose rightly in ordestint in Osaca from 10-20 per cent to So-90 per cent. To tre found 15 000 infected in the state of Changas and 1000 on the state of Osaca.

In Africa the disease is common along the west coast from Sierra Leone and Liberia on the north to the Cameroons and the Congo on the south. In the Congo it extends eastwardly into Uganda and Aenya 1939 and Nyasaland 1939 and it has more recently been reported in the southern Sudan and in Kahirondo (1906).

The fless which transmit the disease in Africa breed in lower altitudes below roop feet and corresponding to this distribution of the fly we find the disease in Africa very common below 1500 feet—as in Liberia Sierra Leone and parts of the Belgian Congo. The rate of infection varies considerably in the different districts in Africa. Thus Blacklock found in Sierra Leone that 45 per cent of 123 natives examined were infected Brumpt, Rodhain and Duboss state that from 50 to 60 per cent of the natives in the different districts of the Congo are infected. Hissettle reported that the rate of infection in the Katanga in the village of Ilebo was 73 per cent and the writer and his colleagues found in Malele (Promoce of Lusambo) that almost every inhabitant of this village was infected.

Ebology—The adult Onchocerce parasites are found in the nodules of tumors, either in dilated spaces or embedded in the connective issue of the nodules. The male parasites on account of their comparatively short length often may be obtained unhocken and without great difficulty by dissection of the central portions of the tumors. However the female parasites are so interfaced within tissue that they are very difficult to secure entire by dissection of

The adult parasites are white opalescool nematodes with conspictions transverse annular intricentage of the conties and reinforced externally by spiral thekenings (the conties are reinforced externally by spiral thekenings (the continuation) and the spiral continuation of the properties of the prope

The female is considerably longer measuring 335 to 500 mm in length 0 27 to 0.4 mm in greatest breadth. The vulva is situated 0, to 0.82 mm from the antenor extremity and the tail is curved. The uterus usually is filled with ova or embryos. The species is vurparous.

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Fig. 308—(1) O I (auda' t m by fm 1 latr 1 vaew (2) O a f ar O um t k n I m ut rus show g ild p la f 1 m nts Cam a lue da d wag M pris t cons and at d by scal t t d ffigut es (Alt c dgrud)

Ochotereas (quo) by it! tuning of the mittoflarue of the Mexican paras to found that six is giftom the head if a non-inclused portion occ pied 5 per cent of the total length the pre-nervous region 42 the network ring 37 from the head and occupied 16 per cent. The exterior pore was 345 per cent the cells of Rodenwall to 3 per cent the anal po eo per ce at and the mode at ordoner noticed at 6 per cent.

The presence of the microfilaria has also been reported in the lymphatic plands especially the inguinal gland. However the adult parasites have not usually been found in man outside of nodules or tumors. Whether the microfilariae are entrally found in the deeper tissues and the viscera is still questioned.

Mache and Corson performed autoposes upon a cases in the Gold Coast in which microfilariat were found in the skin but they were not present in the viscers. Honever in these cases no nodules were found and the adult Onchocerca parasites were not dis covered in any part of the budy though they were looked for

In 1931 the writer reported upon a patient 29 years of are with a tumor of the head and loss of vision in both eyes who died apparently from general peritonitis. Per my sion was obtained to perform only an incomplete autopsy. Adult Onchocerco were found in the tumor Viccoulariae were found in large numbers in the periphery of the tumor in the skin in the comm and in the eyes especially in the com a The examination of film preparations made from the laver and of the stained sections of this organ showed no microfilariae Rodham and Gaszilov 1935 reported upon the histological studies of tissues which had been sent them from a fatal case of leprosy occurring in Leopold ille Belgian Con. o However neither during life not at aut psy was there any report of the discovery of nodules or Onchoverca in this case Apparently no blood examination had been made and no tissue from the skin or eye was sent to Rodham for examination Rodham lound in the sections pieces of microfilanae in the mammary gland and heer in small numbers in the spices and a few in the kidney They were also found in the cubital nerve In this connection it should be noted that blotz in 1930 reported upon the occurrence of microplarize of Los ha in the spicen In 1917 Rodham reported upon the hi tological study of the tissues of two other cases which had been sent him. In the fi st of these three nodules were found at autopsy by Dr Lesman in Kasai Rodham found in the sections from this case that puccefilariat were present in the skin in small numbers but not in the deeper tissues or viscera. In the second case there were no choscal details except that it had been stated that the patient had onehocerciasis. In decar subting the kidney which was sent to Kodhain be found a dozen adult Acoust echesloner; persta is Apparently no sections of adult Onchorered were found in the histological study but microfilariae were found in the sections of the skin as well as in the viccera. In sections of the tissues it is often difficult to make a diagnosis of the genus of the infecting para ite from small pieces of the microfilariae Nettel (1933) performed two other autopsies on cases in Mexico He examined all the organs for outrofilanae but failed to find them although be found them in the cutaneous nodules or crists. Hence in order to a certain to what extent and how frequently the microfilance resade the deeper tissues fa ther studies are desirable with complete autopaies in whi h adult Onchocerca are found and histological study of the tissues is made

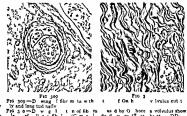
Pathology —The adult parasites are clearly the inciting factor in the production of the nodules or tumors. In addition to the production of the tumors pathological conditions may result in the skin and in the tissues of the eye, especially the conjunctiva iris and cornea sometimes in the choroid and retina. In these lesions which are generally of a mild inflammatory nature microfilariae are often present and not the adult parasite.

The nodules or tumors are enclosed in a fibrous capsule and contain especially in the central portions, usually several adult fibraril parasites and numerous microfilana: though the number of adult parasites and numerous microfilana: though the number of adult parasites in the tumor is variable. In some cases the tumors are spherical in others they are lentil shaped. They are found embedded in the substitations tissue, particularly in regions where the perspheral lymphatics converge. Some times they he in shallow depressions on the surface of the skull, the personaum enterprise that the personaum and in the interior surface of the cyst wall. In some cases the periosetum apparament has become absorbed. The appearance of the tumors studied in Gautemials and in Africa are

similar The structure of the tumors varies to some extent according

to their age. Usually they are firm and grayish white at the periphery but there are often soft areas in the more central portions and these some times have a yellowish or orange color. In other instances the central portions are composed of grumous material with a milky appearance. It is in these toff areas or eartives that the adult parasites are particularly found together with enormous numbers of the microfilariae.

III integral (unation of the nodules who so that immediately about the parasites there is often that not at a yet endered of an inflammatory c cition of a granulomate or character. This is probably caused by the press coof the parasite. A few polymorpho nuclear fuercopts and end sheld a phagogytes are sattered about with more turnerous small round cell occasio at lasma cells and do in plals. The issue about the cut sections of the parasites somet mest c . sits, chelly of dibroblasts and cumbers of diadolth all cells by g . thin a more o les organized firmious evodate. Such issue however is not nichly suscharacted in the ch reat site ma ner of granulation tissues.



You have been to have the nor fish me as day O hoce a volvoid sthow g be of I no fish in (Cmr 1 dad w gs (Z ts b) ct DD me ating ula 0) II dbbrs Fp dt n 193) and the property of the state
mild inflammatory reaction the solule is comp sed largely of throus connective issue in the doler and larger is more the throblasts may be ten in number and the flow jath in this dost abundant it is obles in such instances being composed particularly of collages filters forming as y bendles. In no of the term is site for marked evidence of melosis in a cells only be present a different portions but usually they are not of melosis in a cells only be present and first outperformed the sum of the collection of the cells are considered in the cells of the cells are considered in the cells are considered as the cells are cells

The lesions fou d in the skin and tissu s of the eye are in gen ral of a mild inflam matory nature with p rivascular prol feration a d infigration of the tissues with

lymphocytes polymorphonuclear leucocytes and plasma cells numerous microfilance being present also The cosmopluls also usually are increased. The lesions in the skin and eyes are considered in detail under the subject of Complications

Transmission - The disease is transmitted by the bites of several species of small black flies of the genus Simulium This fly is found breeding in the rather swiftly flowing streams or brooks that abound in the infected districts the larvae and pupae of the flies being attached particularly to the leaves and stems of plants, especially floating grasses growing or immersed in the running water, as well as to the surfaces of stones or logs Blacklock, working in Sierra Leone first showed that Simulium domnosum is capable of transmitting the infection in Africa and described the complete development of Onchocerca volvulus in this fly Shattuck Bequaert and the writer were able to find confirmatory evidence of this fact in Liberia a short time after Blacklock's publica tions in 1925 In 1931 Bequaert and the writer showed that in Gaute mala three species of simulium are capable of transmitting the infection in Guatemala as follows Simulium andum (syn S metallicum) ? ochraceum and S moosers (syn S callidum) while Hoffmann reported finding developmental forms of the parasite in Simulium moosers in Mexico Finally, Hissette Bequaert Sandground and the writer (1934) found that Simulium nea er may also transmit the infection in the Province of Lusambo This has been confirmed for Kasirondo by McMahon (1940)

McMahon (1941) in Kenya found that practically all the flies were S neares and

of 557 flies dissected 49 were infected

The microfilance after being ingested by the fly pass from the gut to the thoracic muscles They first increase in length and then become very much broader lose much of their motility and finally assume the sausage form. After several moults have been accomplished the parasite assumes longer and more slender forms which posse a marked activity and pass from the thoracic muscles particularly to the head and proboscis We have repeatedly observed all stages of the development of the parasite in the fly from the time of the ingestion of the microfilarize from the skin of the infected individual up to the fully developed infective filarial forms in the thoracic muscles head and proboscis

In Guatemala about a per cent of the wild simulate flies captured in the endemic districts were found infected with the parasite. In one village in Lusambo Belgian Congo where the rate of human infection was very high 33 per cent of the wild simulium

flies were injected with the parasite

Only the female fly bites and transmits the infection. The Simulfidate are day biting flies beginning to bite about 6 am and bite freely usually between 8 am to s or 6 pm. The face neck feet ankles wrists and arms of natives in the endemic regions usually are exposed and the files are frequently found biting in all these localities

Mammalian Hosis - In the study of the nrigin of the disease in Africa examinations were made of the fauna of the different regions to ascertain if another mammalian host besides man could be found for the parasite O val ulus Species of Onchocerca were found in antelope and buffalo Bubalus caffer not giving rise to nodules and not identical morphologically with the former species. However subsequently in the eland antelope (Tauretragus oryx pattersonianus) subcutaneous nodules were found in which a species of Onchoteres was present apparently identical morphologically with O volculus Cattle in the region to the south and in West Africa also show nodules con taining this same species of Onclocerca (Cameron Le Roux and the writer) It seems probable that in onchocerciasis a species of antelope may sometimes act as a reservoir of the parasite It al o seems possible that human infection may have been originally accounted from wild animals or cartle. In a pygmy village where Simulium were bighly infected the inhabitants also were badly infected with onchocerciasis Pygmies

as is well known spend a large part of their 1 fe in hunting wild game. They do not till the soil or have any regular agricultural pursuits. Now that strains of the para site have been thoroughly established in man in tirica Guatemala and Merico they are transmitted by S multium from mar to man entirely independently of other animals.

Cluncal Features Incumation I Ession—The development of the nodules or tumors occurs slowly but there is sevidence of the occurrence of small nodules in children under one year of age. Robles reported the presence of a nodule in 2 children under 3 months of age. The water has seen to case in young children 4 of whom were not over 10 months of age. The rate at which the nodule increases in size probably varies in different individuals and with the number of adult parasites within the tumor. Also the tendency to keloid formation in some cases may be one factor.

AGE SEX AND RACE—The nodules while not uncommon in children are more common in adults. Hen are somewhat more frequently infected than women. In Africa, infection in white then has been rather rare only one so cases have been reported. However, in Guiatemala, infection in Europeans is not very uncommon.

SUBCUTAVENOUS NODLIES — The subcutaneous nodules or tumors vary in size from 2 to 3 millimeters up to some 5 or 6 centimeters in diameter. The larger tumors are usually of more than 3 or 4 years dutation. They are firm to the touch. Their number and location vary greatly in different individual and in different parts of the world. In parts of Airce as Sierra Leone Liberia and in Guatemala the number of tumors usually varies from 1 or 2 up to 5 or 6 though rarely even more nodules may be present. On the other hand in the Province of Lusambo large numbers of people were found with from 25 to 50 small nodules and some with 150 or more.

The great variation in the number of nodules or tumors in different localities as for example in Guarden Is and Lursahoo or e or in the same locality in my be explained in part on the biass of the different rumber of times that the individual has been bitten with indirect different in an individual has been bitten with indirect different in a customer of the same of the different rumber of times that the which we worked more not usually over it to go it, we never found in any district in which we worked more than a per cent of the will 37 individual sites appeared to the will 37 individual sites appeared to the will 37 individual sites and the water found as high as 333 per cent of many so individual sites of the pease the mober mistance only a cent of the many so individual variation of the pease the mober mistance only a cent of the pease the many so individual with o it is globable that an individual with o it is goodwident to the pease the many so individual with o it.

In Guatemals and Mearco the tumors are commonly altuated in the region of the head especially on the scale comparatively few upon the trunk. However in Sierra Leone Liberia and parts of the Belgian Congo the tumors are usually found on the trunk especially in the intercostal spaces in the audiae on the back around the pelvis and sometimes in the region of the points zarely on the head. On the other hand in the I rownce of Lussimbo Central Africa one may find numerous small noddles wheely scattered over the head shoulders and trust

A satisfactory explanation can not be given regarding the tendency to the location of the tumors upon different parts of the body in different geographical regions. It has been suggested that the joint at which the fly bites may be an important factor in determining the location of the tumor and Blacklock has given some evidence that this may be a factor However there is not yet consincing evidence of this In Guate mala where nodules occur so commonly on the head the flies are found frequently biting upon the legs and the tumors are not found in Cuatemala about the lower extremities Also the scalp of the natives is generally covered with coarse bushy hair and most of the natives wear hats in the day time when the fly bites. The tumors

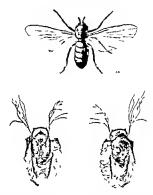


Fig 311 - (Above) Simulium damnosum (Below) Dorsal and ventral aspects of p pa and cocoon of Simulium (Liber a After Bequaert)

often form on parts of the body where the lymphatics converge and where pressure for various reasons is likely to occur It seems possible that the frequency of the nodu es on the head in Guatemala may be influenced by the lymph vessels of the subcutaneous tissues of the head becoming constricted in some way hy hats or head bands worn in the daytime or by the head resting upon a hard pillow or some wooden object at night as is customary there

The tumors when situated upon the trunk usually cause little or no inconvenience, though sometimes they cause pain. They rarely suppurate and give rise to abscess but in a few instances where death of the adult parasites has occurred or secondary bacterial infection abscess has resulted When the tumors are located about the joints they are

more likely to cause disturbance by becoming inflamed and painful When they are situated in the region of the scalp or about the shoulders ocular complications are more likely to result eventually

CASES WITHOUT NOOLES—Whale in the majority of the human case of onchocerciasis sooner or later a definite nodule forms about the adult Onchocerca as a result of the irration which the parasite everts in the surrounding lissues there are instances of human infection in which there are microfilance present in the skin in which no nodule or tumor can be recognized and when there has been no history of a tumor. In horses cattle buffalo and autleape adult parasites of species of Onchocerco.



Fig 31s—Slightly dv 1 p d a co d 1 val t g of O J the thor mu cle f S m l m metall s m appro mat ly 48 hou z ite f ed g upon nf ted p t t fff rva d O hoc r s R port 1931)

(some identical in morphology with O volvulus) may occur in the regions of tendons especially the ligamentum nuchae and not inclosed within definite nodules

The writer especially for these reasons may sted that the h man spec a of O do co may also bountsmes occur in me nas may be attending on free mit he substitute out true. However although the solubl Oschoeve a has been he was in man muce also, it so only comparatively recent lath at a report has been puble bed in which a cent is adult parasite basilees founded mann out of of a module. Sharp in 1979 identified is a dull parasite basilees founded mann out of of a module. Sharp in 1979 identified is an ulteracted condition of the food has Portham and Bonden no state out that this parasite might have been set fee from a module by surgious size. However van des melting of the state of the st

Blood—The differential count of the leucocytes usually will reveal an cosmophilia Montpellier and Lacroty have called attention to the high increase in the ecsinophilie cells in the blood in infection in Africa. In Guatemala the writer and Bennett have found cosmophile counts varying from 25 to 50 per cent while Hoffmann (1930) in Mexico found counts varying between 20 and 75 per cent with an average of 37 per cent



Fig. 313.—The d and fourth stage larved forms of O their rea from Sin lines forms 3 and 4 are approaching the typ of the form of twee for m in form 5 is the infective form for man of microfilariae (Onchocerea e cent ens) from the head of Sim lines

Complications:—In many individuals that apparently possess a special susceptibility to the products of metabolism and perhaps to the presence and movements of the parasites inflammatory lesions occur in the eyes and in the skin. However, in many other individuals these secondary disturbances do not result. The origin of these secondary lesions is not entirely clear. It has been suggested that the inciting factor is (1) a circulating toxin that has been excreted by the adult parasites in the

nodules or (2) the presence and movements the products of metabolism and death of the microfilance in the skin and eyes



Pic 314-O hoc re l'tumo of the 2c lp Guatemal (Harv d On hoc re Rep t 1934)



Rodhain ad Dubois (193) suggested that the prusion is conection with disturbances of the skin occurred as the result of an allerg creation a sensibility to filarial autigm which varied in different such iduals. D Hooghe thinks that the microfilariae

play only a secondary role in the cutaneous letions and that they are due to allerine reactions depending upon the antigen liberated by the macrofilance in the sensured human host especially at the time of birth of the microfilance. Hissette believes the ocular disturbance due to the microfilance themselves and not to a town extre of b the adult parasites. Opinions are therefore durified as to what is the most important



Fig. 316 -- Onchocercal nodule with erodermatic condition of the skin



Fir 317 -S et on of skin illust at ag m ny m crofilaria in cor um

mening factor in bringin, about the inflammatory changes. Shafi believes that the abun reaction produced by enchenceral infestable varies with the aversity of the infection. The writer thinks that while seventy of the infection is one factor of importance the susceptibility of the pattern is apparently a very important additional factor Rodhart and Dubous found in skin tests made with an anal, an obtained from O rel ulut. Les for and Actions that at most more level prescribe on an obtained in patients abover.

subject to prurigo In one person with O relivals infection and no pruri o there was no skin reaction. The role that the m crofilarise play in the production of the inflam matory changes is not clear. It is well known that uncrofilarise of other species of



Pic 38-Oul meh : (s swith d n dk tt Ai



Pic 319-0 hecs with I t all form I n fp u (Aft H it) I Hrv r I Aft c n E ped t R port

F farta within the blood v ssels produce no les ons. Ho vever the anchocercal micro filariae are not within the blood vessels. In this connection in so of interest to recall that Alotz who studied in two cases the

In this connection it is of interest to recall that k-lots who studied in two cases the effect of Microfilaria los in the spleen found about g oups of microfilariae an inflam

matory reaction and fitness and numerous endothelul cells and cosmophis the emphasizes that the temporary setting, of the microfilarian within the viscerial appliance is unaccompanied by tissue reaction while a more permanent abode of them as seen the spiten is associated with inflammation and fibrows. Profilance (1927) in the set such of the tissues from a case of one-hocercassis complicated with Acanthochialoman portion inflation of the size of the compliance of the size of the size of the did not find any lessons in the liver associated with the microfilariae encountered there which were either Historifilary spristus or Merzofilars is duling. In onchocated sobservations have merely shown that in the skin and conjunctive and other portions of the eye in which the microfilariae are numerous milliammatory reactions may occur and

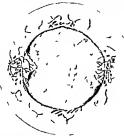


Fig 320 -Ocular onchocercias punctate keratit s and e ly lateral pannus (After Hissette)

that it seems probable that their presence products of metabolism death and dis integration are of importance in the production of the lesions in question

Skin Lesions —Since the investigations of O Neil and Montpellier and Lacroix in rg o it has been recognized that one form of 'craw craw or gale filarienne' is a dermal manifestation of onchocerciasis

In old cases of the disease prunginous and zerodernatious conditions may be observed. The slam lesions sometimes consist of isolated or confluent prunginous areas in which there is slight induration and some times slight changes in pigmentation. The inflammatory process is frequently increased by scratching. In such areas sections of the sla show a few or numerous microfilariae in the contum with penvascular proliferation and inflitration of the contum with lymphocytes polymorphonuclear leucocytes or plasma cells. The cosinophils in the skin are frequently numerous. In other cases generally of long duration are frequently numerous. In other cases generally of long duration is sections of such skin microfilariae are frequently found usually with more or less cellular infiltration of the contum and in some areas the sebaccous or sweat glands are few or absent, and there are changes in the

thickness of the horny layer of the skin. However, in some cases with advanced lesions no microfilariae at all are encountered in the corium

It should be recalled that the microfilariae in the subcutianeous tissues are probably in constaint mot on. 4 to one moment a most minute section of the skin may reveal as many as roo motile microfilariae. A short time afterwards or the following day a sect on of the skin made close to the same locality will reveal only several or no microfilariae whatever. Great changes in the number and in the presence or absence of microfilariae from certain, reaso of the skin at different times have been repeatedly demonstrated

The ad anced lessons of the skin ha e been studied particularly by Fulleborn D Hooghe and Rodham and Valcke D Hooghe (1934) observed 6 cases in Europeans in 3 of which there was marked prungo. He regarded the prungious lessons and the periodic en_orgeneric of the tumors as due to an allergic response to an antigen which mass pokably produced at the time of periodic brint of the microblariane.



a junct v eg fel s v body (Ouchoe s Repo t Ha vs d 930)

Rodhau and Jakke (1935) have all examined a more case; in Europeans in which microfilars were present in the fluid from the pinctured modules. Though now were seen in the skin atthough spiritudes seen in the skin atthough principles with the schence lade supports the were that the endryon play of year on dury role in the seast tration of the skin in and that the absence of microfilarite in the skin in ases with thir r e princip supports the theory that the princip may be considered as a manifestation of ladery dep nding upon melection with O disc earler? I see that the skin changes of the princip of the skin in the skin changes in the skin changes and the weathel [O also agreed in the steem possible that the skin changes in the skin cha

ometim a seen an onchocorera is may be influenced or even due to long standing attacks b > S mid any home the can sometimes arritate for a good of a week. In a dyndraid sepecially suspect fibe to the mitating effects of the bites of these files to the torum introduced by the bite is e ideally sometimes a contributing factor to bring, in about the influencing or changes and lichesingscause openitumes soly revel

Robles first pointed out that the parasite sometimes produced a d fin to type of trysipelas which was termed a to pela dela costa. The crysipelas usually occurred about

the face and eyes and there was often a rise of temperature. This condition was also noted by other Gustemlan physicians. It has been suggested that it is an allergic phenomenon or that perhaps by scratching a bacterial infection of the skin which treptococcus has been superimposed upon a lymphatic system in which circulatory disturbances had already occurred which leads to the ervisibles.

Elephantiasis and hydrocele have also been reported by at least ten investigators as complications of onchocerciasis in Africa Laignet reported a case in which there was a tol ulus cyst upon the side of the chest from which numerous microfilanae of O rol ulus were obtained. There was also elephantiasis of the left foot and beginning on the right However upon centrifugation of the blood microfilance of t perstans were also found Chesterman (1935) in Yakusu has observed many cases of elephantiasis with elephantoid scrotum up to eight and ten pounds in weight together with large and pendulous groin glands D Hooghe (1935) in the Congo also encountered elephantiasis and adenolym phocele in cases of onchocercal infection. In these regions infection with Microfilaria bancrofit and Microfilaria perstans are common. Van den Berghe (1937) al o noted the presence of microfilanae resembling microfilanae of Onchacerca 10 genital elephantia In Guatemala no case of hydrocele or elephantiasis has been reported as a complication of onchocerciasis In the region in which onchocerciasis occurs in Guatemala other forms of filamasis are not encountered. We observed one case of elephantiasis of the leg in Guatemala outside the onchocercal endemic regions but there was no evidence that it was of filarial origin. Obviously if the onchocercal parasites should block and cause lymphatic obstruction and bacterial infection supervene elephantiasis might well follow. In the great majority of the cases the onchocereal parasite evidently comes to rest in the more superficial tissues The numerous authoritative report from Africa show that elephantiasis sometimes occurs in that country in association with onchocercal infection though it is not so common as it i in association with Il schereria ban rolli infection. The fact that elephantiasis occurs in Africa as a complication of oncho cerciasis and not in Guatemala clearly indicates that the elephantiasi is due to another factor besides the presence of the parasite. The importance of secondary bacterial infection in elephantiasis associated with if uchereria bancrofts infection 1 now well recognized. Swelling of the lymphatic glands is not a complication of onehocer class that has been frequently noted though microflame have been found in the inguinal gland on a number of occasions a fact emphasized by Rodhain (1936)

Ocular Complications —Robles (1916) first called attention to the ocular complications in cases of onchocerciasis in Gustemal His observations were confirmed and extended shortly afterwards especially by Luna and Calderon In Merco the lessons of the eyes have been studied more recently by Ochoterena Torroella and Silva and in Africa by Hissette (1932) Bryant (1935), d Hooghe (1935) and in Guatemala and Africa by the water

The ocular disturbances are believed to occur only late in the disease and usually after the infection or nodular lesions have persisted for some 5 or 6 years or more. They generally have an insidious onset. Photo phobia in many cases is the symptom which first disturbs the patient in other instances the discomfort and irritation usually incident to conjunctivitis is first noticed or epiphora may become troublesome affection of the confidence of the confiden

intis beginning at the pupillary border is first noticed. After the intis has developed the pupil is usually contracted and small and sometimes irregular. In some instances myosis results. Photophobia and epi phora are common at this stage of the infection, and impaired vision has already resulted.

Later the aspect of the 1 is itself may change becoming thickened and altered in color and cover of with endude I finestic (a)y emphasizes that indicyclist vished develops slo vity and is characterized by the c interacted pupil the doil clouded into and the perhentic technosis is one of the mot characterists at a constant lesions of on his cercasis. If it continues to progress for a long period a permanent of stu bance of the function of the ris sproduce? I by special illum at n and magnifyin lenies is notion; it is not to be a store et a fine proceptate in Descended since the continues of a deposit of promotion that suntin in surface of the crystaline lenies here the two exceptables of the continues of the con

In other cases small areas of opacity in the cornea may first attract attention (punctate learnitis). These may increase in size and become confluent. Vascularization of the cornea frequently follows and in many cases pannus becomes well developed. In the earliest stages of the keratitis the size of the opacities in the cornea are so small they can only be detected by the aid of a still tamp in the corneal microscope. Later they may reach one millimeter in dismeter. They may be located between the epithelium and Bowman simethrane in the body of the cornea. At this stage of the di case the sensitiveness of the cornea i greatly le sened or is lost.

In some ad anced carse a deep or hary asculan atom is present in the deeper hayers of the corne giving riset is an intentitual learntist. This is on apper is not when parising a learning salerady established is at the time of it owned. It such carse preciping the properties of the control of the control of the present o

Hit legical Si of as—Histological tudies show th tim the b blar co junctive penally near them pinot of the τ in the loss res miles are shat those seen in sections of the kin. There is often more or le s ma ked per vascular poliferation and milt ation of the surrounding τ is on which depth of the theoretical sin almost prompt of the strength of the surrounding τ is one which depth of the theoretical since τ in the hydre of degeneration of the connectic τ is such a first of the subcompact, as the property of the surrounding the τ in the surrounding the surr

In advanced cases fibroblasts and fibroglia fibrils may be present Similar lesions are found in the iris and cornea In the cornea especially near the periphery vascular zation has often occurred. The capillaries are in places dilated and among the newly formed capillaries there is infiltration with leucocytes plasma cells and occasional fibroblasts The epithelium on the surface of the cornea is sometimes irregular being thinned and destroyed or in other instances is hyperplastic. Exudate containing lymphocytes and sometimes fibroblasts may also be present between Bowman's mem brane and the substantia propria. In places the membrane may be destroyed. Less frequently these changes may be seen in the deeper layers of the cornea proper. In a few advanced cases separation of Descemet's membrane has occurred. The micro filariae are found in the conjunctiva cornea and iris sometimes in association with groups of lymphocytes However they are often absent from these areas but present in adjacent fields of the microscope. When alive they are apparently continually moving In places in the cornea the writer found them when from their appearance and uniform staining reactions they were probably dead. In the anterior portions of the cornea they are found particularly in spaces in the tissue which they apparently create by their movements and in the lymph and newly formed penvascular tissue spaces Hissette has observed in addition general uvertis with degenerative lens changes and discrete retrobular optic neuritis

Prevalence of Ocular Complications -The prevalence of the ocular complications varies considerably in the different regions. In Mexico (in Chiapas) Larumbe (19 6) reported that of a ooo cases of onchocerciasis about 800 developed Leratitis inti and choroiditis and 100 were totally blind Muhlens (1932) writes that at LaGranja Chiapas about 10 to 20 per cent had ocular di turbances. In Guatemala (1931 and 1932) among our onchocerciasis cases disturbances of the eves were encountered in only about a per cent. However, only the robust and well would find employment in the privately owned coffee plantations and the percentage with ocular lesions might be higher in Indian villages away from these plantations. In fact Mira Disz and Estèvez (1934) found that in the examination of 742 cases about 6 coffee plantations in Guatemala 34 8 per cent complained of photophobia and 15 per cent suffered with

Hissette in the northwest Congo found di turbances of the eve very prevalent In the village of Ilebo of 100 persons 63 had di turbances of the eyes due to onchocercal infection 15 or ro per cent were blind 42 of the 68 with disturbances of the eye had

nodules upon the head

Bryant (1935) who has made a study of Sudan blindness in the Anglo Egyptian Sudan believes a large amount of it is due to Onchocerca volvulus infection. In a number of cases of Sudan blindness 58 per cent gave visible evidence of O volvulus infection or 40 per cent more than the average of the adult population

Cruickshank (1934) has also emphasized that 45 per cent of the Anglo Egyptian Sudan population suffer from endemic blindness much of which is due to onchocerciasis

Although ocular di turbances bad been recognized in Guatemala since 1916 prior to 1937 the association of ocular disturbances definitely due to the di case in Africa had not been demonstrated However in a very high percentage of the cases observed the tumors had been encountered upon the trunk or extremities and not situated

upon the head Thus D Hooghe (1935) in the examination of 3448 natives found that 2 1 per cent presented ocular complications and that o 4 to 0 5 per cent had become blind. How ever in the very great majority of the cases nodules were situated upon the trunk the number of fibromata upon the scalp being only 5 7 per cent

Blacklock in Sierra Leone where nodules on the bead were found only in 8 cases

observed no ocular lessons

Relationship to Tumors - Expenence in Africa and Guatemala seems to indicate that those individuals in which the nodules ar tamors are located upon the head or shoulders are more likely to suffer with disturbances of the eyes and that in cases in which the tumor is located at considerable distance from the head ocular lesions are more often absent. It has been conclusively demonstrated that the microfilanae are generally

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found in greatest numbers in the skin in the vicinity of the tumors and that at consider able d stance from the tumors very few or no sucrofilatese may be encountered Guatemala the microfilana were found in the skin most abundant in that of the face

u ually very few or none in that over the ankles or feet

In cases with tumors upon the head neck or shoulders my roulariae do not have so great a distance to reach the eyes as they would in cases with tumors upon the trunk or joints and they are frequently much more numerous in the ocular conjunctivae in cases with nodules about the shoulders and head than in cases with nodules el ewhe e in the body. It would appear that the continual penetration of the dense connective tissue of the cornes by large numbers of microfilariae and the death of many of them there and in the other tissues of the eye may exert a pathological effect as well as any toxin which is produced by the parasites

Obviously it would be wrong to conclude because microfilariae are in rely present in small number in the bulb r conjunctiva that the disturbances of the eye are neces sarrly due to the filanal infection. It should be emphasized that in many cases of onchorercasts the microfilance in the skin may not produce any disturbance of moment So also in the eye the mere presence of a small number of microtilarize in the bulbar conjunctive may not give rise to any I sions of the eye that are demonstrable. In many tropical countries d sturbances of the eves are common for various reasons the individuals being predisposed to such affections through their low de_rec of a telligence their poor kn wedge of bygienic conditions and their general mode of life. In tropical countries heat wind dut and smoke within the house or hit are all important in bringing about ocular disturbances. Avitaminosis xerophthalmia especially when asso tated with hickorial infection trypanosomiasis and arsenical polsoning may also he responsible for much bl ridne a in regions where enchocarciasis pre ails

Movements of Parasites in the Eyes -A symptom sometimes complained of is that relating to entoptic visu n of the microfilariae crossing the usual field. Muhlens and Hi sett have reported that some of their catients have omclained of seein, movements within the eye. In one i Il seette's patients the movements described sugg at disomewhat those of mosquito harvae in vater. To another patient the forms seemed to be black in c lo nd to a third as worms of fire. He s greats these symp toms were probably due to a localizatio of the microfilariae in the neighbo h od of the retina or ch r id nea to the macula zone. Silva with Guilstrand's ophthalmo scope has reported that he has been able to see in the vitreous humor shadows of the moving microfilance. Illusette has observed dead larvae with flakes of firm and pigment in the anterior chamber whil Boase (935) in Uga da s w th microfilariae

m ving acro s the aqueous humor in a blind school teach r

Red and Adams (1018) have also obser ed a two occa in with the slit large microfilanae ir small numbers. The microfilanae removed themselves with remark afte rapidity from the bright light applied by the apparatus. They could only be

observed for a few seconds before leaving the range of 11 ion

Quevedo (194) bel eves the ocul I troubles are caused by the microfilaria in the tissues and ar not due to a toxin produced by the adult parasite. He has ne er failed to find microf lar as in any e e les on caused by o choterca. Lat r the microfilariae can be seen free in the anterior chamber. He has obser dall the ocular changes which have been or v ously recognized

Diagno is -The onebote est tumors a met mes may be confused with dermo d cysts lipomata non pa as tic fib omata and especially with ju t a t cula nodul s Onchocercal tumors simulat very well surts a ticular night s ndf equiptly affect the same regions. I out is frequently impossible to di triguish ci arcally one from the

other without microscopical examin tion

The d agnos s of onch ce eras s may be made by pun ture and a piration of fluid from the nodular tumors and the discovery of the m crofile sae in such fluid. Often seve al hundred p ra t a may be f und p a single d op of the aspirated fl d (S e I'g 322) On the other hand no me ofil a e may be obtained even though the nodule is onchocercal in nature. Sometim a only adult male pa asites or only female p tas tes or dea lp to it sar present a the tomor. If the mic oblamac are not present in such fluid frequently they may be found in small sections of the skin removed by a safety rator blade. In fact, in a given sense the examination of the section of the skin may give a higher percentage of positive findings than the examination of puncture fluid from the nodules. We I favorable results usually are obtained with skin removed from somewhere near the tumor. If the tumor is on the scalp, the theck is a favorable piece. The portion of skin should be transferred to a plass shide and a few drop of moral saline solution added and a coversilip piaced over it. No tensing of the skin is necessary. It is preferable that the sections of the skin should be sufficiently, thin so that practically no blood is drawn in making the section.

In instances in which no nodules are found detection of the micro filariae in sections of the skin or of the conjunctivae is the only satisfactory means we possess for the diagnosis of onchoereral infection. However if no microfilariae are found in the skin it does not exclude the diagnosis of onchoereralises since they are sometimes absent in the skin when true onchoereral nodules are present. In the great majority of cases whether ocular lessons are present or absent the microfilariae may be detected in this section of the bulbar conjunctiva obtained with curved eye esissors. Diagnosis may sometimes be accomplished in an endemic center by the microscopical examination of the contents of the gut of a simuluim fly immediately after it has fed upon an infected patient. Microfilariae sometimes may be encountered in the fly often in considerable numbers even when the direct examination of a section of the skin has been negative. The fly in feeding apparently causes a concentration of the microfilariae at the point of the bite.

In cases with no demonstrable nodules sometimes the presence of cosmophilia 30 per cent or more may suggest the diagnosis as was the case in a patient with ocular disturbances at the Liverpool School of Tropical Medicine in 1938 However cosmophilia may of course occur in other forms of filtrial infection (see p. 1378)

Nettel (topr) reports that in cases with ocular disturbances penauricular nodules are easily over looked that nodules may occur in muscles and attached to fascial planes or other deep nodules may remain underected. Of so cases with blindness penauricular nodules were per ent in all and they are apt to produce oederan of the face and ear

Immus Teactions — Attempts to demonstrate any immune reaction in ordine certains have not been very successful The writer and Bennet truet to asserting hypersensitive reaction could be obtained with an aqueous or alcoholic anti-entering the about parasites or from the adout parasites or from the most possible and introduced and interior
Rodhain and Duboi have perforred the mtradermal test in 3 ca so of onchoccrcass in Airca usin, an anti-en prepared from Onchoccrca tolsular and Los loss or Dirightian institi. They state that the reaction is evidently a group one. Although postive reactions were obtained in the three onchoccrcal case they d d not show the uniformity obtained by them in loss loss of D fedionems fersions infection.

Fulleborn (1931) also prepared an antigen by drying a module e-cised from a case of onchocerciasis. The moculation of this anti-en in two cases with onchocerca nodules

gave typical wheals but not only with them but also with onchoicer a free control sensitive to Ascaris and Stiongsloid's antigens

Tardey (93) uses a D of for a sattigenistates the skin text and c my ker nelf atton one ereb th paratully posture in one ca. ed onch corecasts ofter rome and of the module Also Roddium and λ an den Branden in enther crusis ca. es obtained no favorable results with the complement finant not set using a $O \times and$ at attent for aning n which Montgell er and Bera ad in the such as an ingenetation of the complement finant one text using a $O \times and$ attention for aning n which montgell er and Bera ad in the such as an ingenetation of the control of the con

Also Gutterrez in Me teo prepared an antisen m de of portions of onchocerea parasites extracted from nodules and performed the complement fixation test. Positive react in swere obtained in all cases suffering from onchocerciasis and all of om syphilis and middled noto cases. He enclude that until this source of error has been climit.

nated the reaction can ha e n d agnostic value in onchocerciasis

Hoffmann and Vargas state that by u n an atgres of Guiter's they obt used a more in ked since texton in control in white people not utient of with onch errat than they d d with infected nature. However, the side of the properties of the method of complement f. in a of Calmette and VI sool is modified by Wathus and Labougle with no like object extract of on horera, believe that the t is is a definitely specific one. D Hoogh (1935) which has above people that in the farmal reaction for the state of the side of the complexity of the side of th

Wright & Murdock (f erso 1 minumeration g_44i of if f in p_n skin test than antigon prepared f in f if f in i, i is who had i end i d and employed in dilution of i of bound the react i is so it tape i if i the id i is so i choose i is so in a positive react i might ibe beaused in individual had be not test at

p rasites and n t nch c ca

Differential Diagnoss 1. Opens Helliumstress and Occurs. Differential Diagnoss 1. Opens all Helliumstress design of the companion of the comp

appea that it has a special predilect on for that region

Winght (1924) and Fernando (1925) have reported upon the p scence and remov I from the antenier chamb of the eye of an adult P if p presumed to be Il sude remove I from the antenier chamb of the eye of an adult P if p presumed to be Il sude remove hardered. Altest a d Morrison (1936) noted the presence of an adult P rofler e in mel 1s in the aduced human of the eye of a dog. The symptoms observed in connection with the prese ce of the p resume were conjunctivate increased largy and descharge and if ght poparty of the corne is a chefined by the occasion if desire a first the connection of the corner is a chefined by the occasion of desire and the corner of the corner

N rotals (1931) h s po tel from Ind a f outnoment tumors in a child which were trit diagnosed a d displacan the eyeb il upwards. Duse t on of one was I llowed by the child a deshi section of the tumor to the following the following the first of the tumor of the following the follo

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Instance Reactions:—Attempts to demonstrate any samutor seatton in onchoosercasts have not been very successful. The writer and Bennett not do secretain hypersensitive reactions could be obtained up than acqueut or alcoholic antigen prepared from the adult parasites or from litmost containing the adult parasites and enormous numbers of ova and microfilariae. Such anti-cas were employed in performing both an intradermal test as well as the precipital nextions with the second of cases of undocessional antiadermal containing to the second production of the second production and the second production and the second production are detailed in the second production and the second production and the second production are detailed to the second production and the second production and the second production are detailed to the second production and the second production an

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ge us Chellosp rura have hitherto only been reported as parasites between the tunics of the guzzard of birds in different parts of the world

Babudien (1937) has reported a case of human filariasis due to Fila ia co junct ac Addano 1885 with a nodule on the left check. He also describes in detail the paras te which was removed and conside a the 7 other cases of human infection that had previou ly occurred in which cystic turn is of the evelde verball and skin of the nose

and other localities had been reported

Deportes (1920) has for d an mm tree adult of File a conjunct use and classifier in the genus Droglymas. He also notes in the tips care has been found occasionally in cyst like tumors of the eye nose arms and meentery in Europe and in India. The femnle parasities are eye-nor long and of 5 mm broad. The parasitie in India 1 the femnle parasities are eye-nor long and of 5 mm broad. The parasitie is reported as causing a birran, or steling sensation and localized orderna. One male D florar seeks has been reported from a nodelie in the evided of a woman in Russian.

RECENT REPORTS OF DIAGNOSIS WITH THE OPHTHALMOSCOPE AND CORNLAL MICROSCOPE

Estrado Torres has found that microfilariae in the vitreous are most causily seen with the electric direct image ophthalmoscope using a + 100 to +40 diopter lens. Vitrohlariae seen with the ophthalmoscope by transmitted light resemble fine black filaments on a reddsh background. They reminded him of the appearance of mosquito larvae in water. The microfilariae seen in the anterior chamber with the corneal microscope with direct light are white very fine active filaments with golden reflections. Torres points out the simplicity of the use of the electric ophthal moscope in diagnosis of the affection and that general practitioners and micros can detect microfilariae with it. He extanined it caves of oncho cerciasis and found the microfilariae in all by ophthalmoscopic examination of the vitroous.

Semadem (1943) has reported upon the histology of the eyes of a Swiss geologist affected with onchocerciasis which he contracted either in the Sudan or in Algeria The condition was diagnosed with a slit lamp corneal microscope which revealed about 300 living microfilariae especially in the anterior layers of the corneal parenchyma. The eyes showed reddening around the cornea which were slightly clouded by many inflammatory foct with slight panus formation in places on the corneal margin was an cosmophilia of 25%. The patient was given emetine and foundin However he died as the result of a mountaineering accident. At the autopsy adult onchocerca were not found but sections of the eye confirmed the presence of microfilariae in it. They were practically everywhere where there were lymphatics they were found in the corneal parenchyma where there was inflammatory reaction but no cellular infiltration around the microfilariae They were also present in the subconjunctival tissue in the iris and especially in the ciliary body. None were present in the choroid vitreous humour retina lens or optic nerve. The slit lamp micro cope made possible the diagnosis during life

Graham Scott (1944) has described an ocular syndrome in which is oederna of the upper lid is proptosis is ciliary flush and 4 oederna of the optic nerve occurred as unlateral phenomena in is patients with oncho

In three cases the nodules contained worms the fragments of the parasites occupying clearly defined spaces within the arran of account. The shole sures of cases showed a high average cosmophist. Embryos or own were not found in the states. The possibility of such a worm belonging to the genus. Find on a war provided from the cases of human infestation by Their set allipseds have been reported from thus, to so of these (Stuckey toy; and Trimble 1917) the worms seer found in the ron lunctual see. However the latter patient suffered severe 5 mptons with ectopoin and excessive facinities the strength of the word of the control of th



Fig. 323 —Photom crograph of larval forms of Onchocerea volvolus. Most film preparate on made from cut acet on of tumor. (Hatva if Guatemala Expedit on 1920)

and more recently Faust (1937) have demonstrated that the human and dog parasite in China belong to the same species? Idea is earlipaded. Afthe case has been reported by Koloid and Walkams (1935) from Cahlorma (the first in the United States). The patient had mild computativities and 3 worms 10 to 17 mm in length were removed from the eye. Koloid has named this new species. The total of Jornessis.

The chinical appearance in the cases of bung-eye and bulge-eye evidently differs greatly from that observed in the cases of human Tida as infection observed in China.

Owen and Hennessey state that the question of the acological status of the parasite which they found must rest in abeycance until surther material has been obtained. It nould appear unlikely that the parasite concerned is a species of Onchocord.

Africa and Garcia (1936) have reported a case with bithing and redness of the comjunctiva with factimation photophobia and dimenses of vision in the right eye. A diagnosis of chronic extartial conjunctivities and heralities was later made and the removal of a small nodule in the lower pospebatic agranticity as a found is contain sections of a pursaite chargeoned as a species of Chesterpriser. The encystodes of the



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cereasis. He points out that this syndrome is not a familiar one in keneral ophthalium practice and he suggests that a lymphate block directly due to incrofthrane or inducedly due to finant towem as in calabar swellings is in explanation of the four symptoms. Microfilariae are demonstrated in both cases in the eye or in the skin. In only one case were onchoever an oddless found.

Prognosis —There is general agreement in the recent ob ervations of Larumbe Hoffmann. Mushlens and Hissetti with reference to the ocular lesions only occurring as late disturbances and only unusity after the infection or nodular lesi as has e persisted for some 3 of 5 years or more.

The idea priviously expressed by some early observers that the removal of the onchoerest ejects resulted in the disappearance of occlus disturbances and a return to a nemal vision has been shown by many retent observations to be interrect especially through the observations of Hismana Mabliens Torogolls Side Hissette and the writer. The removal of the nodules however with the adult forms if there are not offer conceiled adult parameter remaining reduces the number of microflyrance or culating in the tissues of the eye and may arrest the ocular lessons but if anatomical changes have already occurred obviously removal of the nodule may bear no exceptible favorable inducence. I animal e-cilied affersion to the fact that the ambitration of the evolute symptom spans became agravated in the output of the private of the evolute symptom spans became agravated interest has abserved that this temporary improvement in many cases does not mad be suggested that the temporary improvement in the symptom may be an alternation which results from the content of the content

A number of the early reports in which the restoration of synight or an importer ment of usion was believed to have occurred immodestly following the remined the tumor are pethings not so difficult to understand when one considers the low degree of inchigence of many of the Indians among which the disease (reash and their persistence and impressionable nature. I specially if the idea were suggest to them that their susons had been improved by the operation in they would generally be included to agree with such a suggestion. In Gustenist among many of the Indians in the infected district there is a feeting this green, all of the tumor after a time in hely to lead in the could restorate the could rounding. This is one of the resion in why the fails will be a willing and often eager to have the nodules removed an I through this covergestance the readiction and control of the dispeases a made more presentations.

Whether a torus secreted by either the adult parisetes or the microfilarius is responsible or to what extent such tooms are representable for the occular levisions has not yet been conclusively demonstrated. The occular lessions probably are influenced by the presence and movements of large numbers of amortification in the times and the period of the probability of the control of the period of the period of the probability of t

It seems (robable that the curculators di turbances in the ti sues of the eve may predispose to accordary bacterul indections and when occurring in the bulbar conjunctiva predispose among other pathological conditions to junguecula and to pitergium With the removal of the adult parasites in the tumors derantological disturbances.

also appear to be at least sometimes ameliorated or perhal a prevented

In patients with large numbers of nodules (note one hundred for example) the progness is unfavorable both because us by patients are evidently frequently exposed to remote that and because it is importantable to remove all the noduler or to district injection the parasites in all of them as the patient will not submit to the repeated sufficient from such a prolonged procedure

is most important. However protection from the bites of Simulium and destruction of these flies are most desirable in all countries where the disease prevails. In Guatemala the eradication of the Simulium concerned in transmission in the endemic areas is very difficult for its breeding places are so widely distributed in practically every flowing stream of water in the neighborhood and such streams constitute the only water supply of the districts Erudication of the fires through attempting to destroy the larvae and pupae in the streams by changing the vegetation along the banks by cutting and raking weeds on which the larvae or punge are fixed and by the removal of logs and stones or the scrubbing of them with stiff brushes have all been suggested but these are not very practicable preventive measures. Oiling of streams par ticularly with phinotas oil O kane has found especially in New Hampshire to offer a certain measure of value for control of Simulium. In streams or waterways in which fish of value are not present the larvae may be rapidly killed and the problem of concentration of the oil in the water does not offer much difficulty Such measures would not be of practical value in Guatemala

Ho vever Dampf (1942) thi ks creolin by the dripping method in small streams in Memories of value spains 5 of acc 1 though nly practicable in the dry reason Op nins differ some hat as to that have been the most efficient and practical

measures for the eradicati in of the disease in Central Annua, a of the awhigh have been projectured against it during the extensive campai us well did Nexico and Guatemala in the past fet years. K s s (937) Chief of the Fede all Samitary Brigade in Mexico emphasizes thus fact.

Lerrandas Chaf of the Sanstary Br ade in the go of the control of unchoosercass in the State of Chappas Serious Often 1911—93 is emphasized the importance of the missiance directed against the late of Sansul dae a d believes they constitute the unstanded of the Chappas Individual of the Chappas Individu

Observations made in Guatemala during recent years continue to show that the infected induction constitutes an important focus of infection and surgical removal of the timors containing the adult parasites has been in vogue for several years in that country as a public health procedure of importance for the eradication of onchoerciasis. The writer believes that the surgical removal of the immors and complete and speedy removal of the parasites within them is the procedure of choice. However, where surgical removal of a large number of tumors in large groups of patients is not practicable, and the patient objects to this procedure or the number of tumors in the undividuals large the injection of the tumors with different drugs for the destruction of the adult parasites has been recommended.

In Guatemala where a systematic attempt has been made in sharply-crounscribed areas to criticates it bears in Estemals he massed mally leved. Innocephantation Moca whe e the camping agan it the die a was ried by puriette during 1911 upon Moca whe e the camping agan it the die a was ried by puriette during 1911 upon forestammatic of the mala Istatis a 1932 the rie flow mit effective was found to be greatly reduced as a salos the rate of the forest in the mit reduced by the bean such has influenced by the clim to factors a that area in 1912. During the net 44 years when the campiagn aga at the duess was related the rate of infection forest again. In our sangitude requiring was surpus understate in Gustemala under when

Treatment—The tumors or nothles should be emoved mall in mass, once unlayability with such tumors, unless the puras es within them are duel count ute tota of increase as the reade in a during when the crowdle is liked how as present. Their removal may also princil dermal or earth, complications.

Whoseh when the creat in edition the arms the sime since can, I de importante to the patient by their processes when located their joins they are more likely to become immed and joinful. When the time we is to edition the bad and about the time possible of control at the expective street to conduct data the possibility of certain data to to so of deathing, it possibilities of certain data that pursues is may be appended in noduces and reproduce mineralizate in the are condition, removal of white noduces should at left, reduce the secreta of the time too with introduction. The operation, it is sayle and easily performed total boals not conceined in the chest. From so to 50 cases may be open of

mon in one day.

Herere when the tem is an compare time that the manufacture do not always.

charmed tollway the everyon, it i may been a racingterful most thereare Their remainmen may be dry in some includes to the east more of adult rains in amentarent, ed o trus in corrected and its. In attempt may be made to a the readed of the mornature which may person at or the motoral of the tomas (a which בתו שונים של זיל לותו ליל כבו אל יום לאל הוא מו לומורות מו בשפר בה enterances. The we er en it is shown that several direct may be employed which energiese dott v the marameter of the an though their are tarter ement, failing and nasmrchm. Tatta come has eathly ed the most tampoid effect. American results have been renered by Which and Charleson, and Khaw and Charles and to at in the treament and cure of Der Jane men substitute in dere be in ettims of tourdin Johns rue (10 ha. also for 3 tha i medis . Il deur v the mero... arme m d in bit not the summ trees when the drive shed casted is at the death of the dr Attended to the chesh dury of the same of the for the total and state and attended In two of the tre. Liver warms were I and at an err but there were no larrer in the females. Tarter ement, while more effective is to re note a as than forman. While bribal the are never are certainly in minutes to the ent. The of micro area at a fill derbiful whether the moroellanus so the brite can all be decrered by diver of three draw which aren it in torthe papers. Harm stought models a ner removal o middles, treat the recessories at four Col aw 5 street course streets as server the distriction of the four or real a court or a set as and be a set and the provider a court will

dams to 5' has rewried a case in Londra with ordin lessors and microslanse in the conjunctiva but with no demonstrable rutaneous lessors. In the case it was thought that a course of needshown arrived the progress of the eventual that he can be uncompliance were subsection.

quently found.

Lase (10, 8) does not believe that an more compounds destror the larrar, but thinks that the team sometimes either the adult parts a and poison the oral rendering it territorially settle. Murrational (10, 8) believes the cells, symptoms are due to the increolalists since the surgical removal of the adult, fails to effect a cure in many case. He suggests that attempts at descr. Institute the reducted does of tilms anticen may be a cell, all preferent to the other treatment.

Eradication. In Caunci, is which the disease is sharply circumscribed, as in parts of Guaternals, the eradication of the human foct of infection

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However Dampi (1942) thinks creoks by the dripping method in small streams in Mexico 1 of value against S ochraceum though only practicable in the dry season

Opinions diffe somewhat a to what ha e been the most efficient and practical measure for the end cat a of the desses in Central America of those which have been price ted against it during the entensive camp just waged in Micato and G atemala in the past few yea s Ro as (1037) Chief of the Federal Sanitary Brigade in Me commhasses this fit.

empeasures into t.c.

Lo cazana Chief of the Sanitary Brayade in charge of the control of onchocerciass
the St te of Chapas Menco from 1911-1933 emphasized the mporta ce of the
measures directed against the 1 as of Simulations and believes they c nst tute the
only effic t method for the control of the d see so Chapas However great difficulty
was med with in cary in out successful and larval me sue see in that country or in

reduc a the disease maters lly by them

Observations made in Guatemala during recent years continue to show that the infected individual constitutes an important focus of infection and surgical removal of the tumors containing the adult parasites has been in voque for several years in that country as a public health procedure of importance for the eradication of onchoerciasis. The writer believes that the surgical removal of the tumors and complete and speedly removal of the parasites within them is the procedure of choice. However where surgical removal of a large number of tumors in large groups of patients is not practicable and the patient objects to this procedure or the number of tumors in the midwalus large the injection of the tumors with different drugs for the destruction of the adult parasites has been recommended.

In Guatemila where a systematic attempt has been made in sharply in cumseribed areasto radic test their testification always maternally/lowered. In nonepantation Moca where the camp it against the diverse was rigidly part used during of it upon for examin to not the inshatiants in 103, the rate of those an inclusion was found to be g atly red ced a was also the rate of fly infect in However the latter may have been a mowhat influenced by the channel of closes in that area in 1032. During the next 4 years when the camputing against the disease was relaxed the rate of infection rose again. In 935 as active campaign was argain undertaken in Guitemila under the

Treatment—The tumors or nodales should be removed in all instances since individuals with such tumors (unless the parasites within them are dead) constitute for of infection if they reside in a distinct where the intermediate insect host is present. Their removal may also prevent dermal or ocular complications

Although when they are situated upon the trunk the tumors may cause intite inconvenience to the patient by their presence when located about joints they are more likely to become inflamed and pariall. When the tumors are situated about the head and shoulders it is especially advisible to remove them in order to avoid or diminish the possibility of ocular disturbances. Even if in certain instances the adult parasites may be unenclosed in modules and reproduce microfilaries in this free condition removal of trisible nodules should at least reduce the security of the infection with microfilaries. The operations are simple and easily performed under local novocaine anaesthesia. From 40 to 50 cases may be operated upon in one day.

However when the tumors are completely removed the microfilance do not always disappear following the operation but may persist for a considerable time thereafter Their persistence may be due in some instances to the existence of adult parantes unenconsulated or lying in conceased nodules. In attempt may be made to rid the patient of the microfilariae which may persist after the removal of the tumors (or which are present in individuals in which nodules cannot be found) by the use of filancidal substances The writer (1932) has shown that several drums may be employed which effectively destroy the microfilance on silve. Among these are testar emetic funding and plasmachin. Tartar emetic has exhibited the most filericidal effect. Successful results have been reported by Wright and Underwood and khar and Chen (1935 and 1936) in the treatment and cure of Directions imm tis infection in dogs by injections of foundin Johnstone (2016) has also found that foundin will destroy the microfilarist in dogs but not the adults even when the drugs used caused later the death of the dog Brown and Sheldon have treated five dogs successfully with fundin and sulfamiliamide In two of the five living worms were found at autopsy but there were no farvae in the Tartar emetic while more effective is more poisonous than foundin While both of the drugs are certainly immical to the existence of microfilarian it is still doubtful whether the microfilarize in the body can all be destroyed by doses of these drugs which are not toxic for the patient Harris (1941) found that after removal of nodules treat ment with intravenous antimony sodium tartrate has followed by disappearance of microflorine from the skin and by a fall in the proportion of cosmophils

Adams (1938) has reported a case in London with ocular lesions and microfilariae in the conjunctiva but with no demonstrable cutaneous lesions. In this case it was thought that a course of neositibosian arrested the progress of the eye trouble though some microfilariae nere subsequently found.

Lane (1938) does not behere that antimony compounds destroy the larvae but thinks that they may sometimes sterifize the adult parasit and poison the ova rendering it temporarily sterile. Murgatroy d (1938) believes the ocular symptoms are due to the microfilaine since the surgical removal of the adults fash to effect a cure in many cases. He suggests that attempts at desensitization by graduated doses of filana antitien may be a useful supplement to the other treatment.

Eradication —In districts in which the disease is sharply circumsended as in parts of Guatemala the eradication of the human foci of infection

in the tumor by puncture although more economical and less troublesome to the patient is much less exact

In Africa D Hooghe (1935) has recommended 0 5 to 1 cc of a 5 per cent solution of thymol in carbon tetrachlonde. He states that the myectoous are somewhat painful and be does not recommend the method for tumous sustanted about the cranium which are dangerous ones in connection with ocular lesions where surgical removal might he more certain in its Getcis

H settle has suggested thorough needling of the tumors with a large syringe needle to destroy the adult parasites. Many of the parasites are undoubtedly wounded or killed in this way but the procedure is painful and not always certain in producing the desired result.

reaur

In Africa where the disease in many localities is not sharply circum scribed and in those in which the rate of human infection and of fly infection is very high the eradication of the breeding places of the fly in the endemic regions constitutes by far the most important problem Eradication of human infection in such districts would be entirely impracticable without the elimination of the fit.

Blacklock also has emphasized the fact. He admits however that the breeding place of the fly are not early to state. He enumerate raising the level of the water of streams then low-enought again scrapio, the channels impeding the rate of flow in order to apphyrate the larges and potting chemicals in the water as measure which have been recommended. He also suggests as further methods to be tred the cleaning out of that streams in the days eather and statishing the breeding place when the water is low. He points out that Hisserte advised the cleaning of the ground for 900 meters from halt intons and thinks that this would have been largely successful in the sort of locality where he was working in Sierra Leone where the 6th had in the lall grass and did not seem to come at any long dit time to attack. He thought that if that condition holds throughout the year the clear glock of the bush and from the villages would result in a considerable reduction in the total sumber of blace.

Conditions of the spread of the disease vary greatly in different localities. It is not believed that clearing of the ground for goom eters from habitations would materially influence the prevalence of the disease in Kassende, where very many of the infections evidently occur outside the village in the fields and about the stream.

Gibbins and Loewenthal with a wide experience in the study of Simulium in Uganda where as high as 14 per cent of the files were found infected while admitting that suppression of Simulium is urgent state that it is futule to attempt this by attacks on their breeding grounds. Gib bins (1936) has found that in Uganda the adults of this insect. Simulium daminium are capable of flying great distances. They twice raided Kampala though local investigations appeared to have shown that there were no breeding places nearer than 4x miles away.

Indeed in some localities in Africa it would appear that satisfactory eradication probably can only be accomplished by extensive sanitary engineering projects and by the provision of a modern water supply for the district. Such changes as gradually occur in the building of modern residential centers should eventually result in the gradual exter immation of the disease. By these and similar measures the breeding places of the first will be removed or gradually reduced and the inhabitants.

direction of Dr. Dirix with the a distance of Dr. Oct or and Mr. Owen South. On account of the thinkuity in many instances of the surgeral removal of the tuners attempts were made to destray the adult; crustates in them by the injection of a number of individuals examined and the precent of the crustal and the process of the crustal and the crustal

11 530 persons examined 14 per cent still infecte

310 cases of Onchocerciasis treated and July 1935 re examined with August 1936

Tumors	Injected with switts de generans	Injected with hery! resorcing!	Total sumorainjecte i
Persiste i Smaller Disappeared	38 (26 2 per cent) 71 (32 2 per cent) 92 (41 3 per cent)	a8 (3: 5 per cent)	od (30 p per ernt) gg (31 p per cent) st5 (37 a per c nt)
	211	\$9	310

TARE 2

	Aumber of persons examined	Number of persons with tumors 1936	Percentage with tumors 1952
Vioca	t 179	sos (22 per cent)	40
Santa Adelai ia	323	39 (47 ; er cent)	38 6
Pacay at	634	101 (30 per cent)	•
Pacay alito	141	56 (40 per cent)	•
Santa I milia	210	120 (52 per cent)	54

So figures avrilille

employed in 1935 and the results of this terriment as absenced in 1936. The layers apprently findice that the treatment employed in the stentilent on the tumors by the injection of several design has been faulty effective and that the rate of infection in 1936 was distincted, have then at was in 1937. The rates of excellent in these plus tations in 1931 and 1936 are also compared in table x. It is in Mo. a that the work of employed in the proposed of the results of t

A subsequent report by Diric at the close of this campiling in 1936 concludes that the removal of the adult librar which adops the 170 bection of microbilizers should be found into all subschockers! therap substant. He believes that higheston of the tumors with the long is the method of choice of killing the adult filters and at the cost behicht of our recreating my crist to 1 et the most portful drag for this purpose.

On the other has I Stere and Bustamente (1937) from ear relence game I as a te year computing against the discussion of largest Mexico prefer the removal I y surpical excession of the tumors because it elaminates the dath cost clearly the results being controlled later I y the absence of microfilatese. They feel that the killing of the norm

Code (1939) has reported that the eosmophile is the carrier of histamine and that histamine is transported in the body by the eosmophile and that the presence of histamine in such cells may partly explain the mech anism which is present in asthma hay fever and other allergic conditions

Finally in Discounsulus infection as Fairley and Liston have found in the study of 125 cises a fee hours preceding the development of the local cutaneous lesson indicating the desire of the gravid female parasite to perforate the skin and to give birth to the enormous number of embry os with which the uterus is engorged pronounced prodromal systemic symptoms appear consisting of crythema and utricarial risk with intense pruntis nausea vomiting diarrhoes severe dispense guiddiness and syncope all believed due to tomenia resulting from activation of the female worm. In a few hours the local papulo vesicular lesion develops. These systemic symptoms together with an cosmophilis obviously simulate those observed in histamine poisoning. Moreover they may be relieved by the administration of aderendine Therefore it would appear that there is considerable evidence in favor of the idea that cosmophilis in filarians occurs especially in connection with an allergier reaction.

Myers and Kouwenaar (1939) and Bonne have observed in a number of cases swelling of the superical lymphatic glands in filarial infection with hypercomphilus especially in the lymphatic glands themselves In two of Myers 7 cases there was bronchal asthma and in two a haemor rhagic nephritis. It was suggested that these two symptoms together with the ecomophila may have a common allergic origin brought about

primarily by the filarial infestation

Dracontiasis

Definition—Dracontiasis may be defined as an invasion of the connective tissues by Dractineulus mechinesiss. The adult female parasite arriving at the surface of the slin produces a local lesion and systemic manifestations especially indicated by urticatia. Senous septic cellulitis sometimes follows rupture of the parasite. The infection is transmitted by sporces of Cycleps

History—Dracinculus medisiens: also known as the Medina or Gunea worm is the oldest known Fibana (Fibaria medina Velsh 1674 Fibaria medinarisi Linnaeus 1758) in fact it has probably been known longer than any other human parasite In early literature it was termed the serpent or dragon worm

It appears to be referred to m the Ruble by Mo ex (Chapter NAI of Numbers), as the ferry seprents that molected the franciers in their sopiours on the shores of the Red Se. More er it was suggested that Mores trught the branches how to extract the worm by windin, at a tound a pre col stok. The tem D obstown sites of occurred in the writings of Agatharchoider 40 BC. Phata the Galea and Loundes lakewise referred to that so dithon and it was well recognized by Faulus Agenus and Avicana who in addition described the method of extraction. Figuretta (595) also evidently observed and it travel of interts in with the part is en in his exe used in lawying ethnough the

1378 EOSINOPHILIA

will no longer come into intimate contact with and will not be exposed to the bite of such files. Such eradication apparently could be accomplished were the financial cost not considered to be too great to justify it.

EGSINOPHILIA IN THARIAL INFECTIOUS

Eosmophila —The origin of the cosmophila which we have noted in some forms of filariasis is of interest. It is usually present in oncho certains and is commonly over 30 per cent. The reason for this parasitic cosmophila is not accurately known. It may also occur in infections with Loal of and less uniformly with Il indepent absorbed last on times in Dracurculus infection. Likeuses it may be present in other nematodal infections particularly with Augiloluma dundenale or Trustingle spraisis.

Blacklock points out that cosmophilia seems to be an attempt on the part of the host to neutralize some totic substance produced for example in numerous behinnthe infections diseases of the skin and in asthma. There is some evidence that cosmophilia may occur as a protective action against foreign proteins and it may be produced by the injection of many foreign proteins. That cosmophilia results from the presence of a foreign protein in helminthic infection is suggested by the fact that it may be most marked in active echinococcus infection when the hydatid cyst has ruptured or is feaking. On the other hand when the cyst dies and becomes calcified then the cosmophilia may disappear and the Cassoni test and the complimentary fixtation reaction becomes negative. The repeated injection of a foreign protein causes tissue cosmophilia at the site of the injection. The fact however that the cosmophilia occurs especially after repeated injections and after a latent period suggests it is an allergic response.

The cosmophilia present in Loa loa infection associated with calabar swellings which swellings occur in the course of this infection is also apparently anaphylactic in origin Chandler (1930) by the injection of a foreign protein (Dirofiloria antigen) into a patient infected with Log log was able to obtain a typical calabar swelling Fulleborn (1932) finally confirmed this Pairley also (1932) after a further study of skin tests in loiasis has concluded that the calabar swellings essentially arise from a local anaphy lactoid reaction involving the cells of the sub cutaneous tissue not primarily of the dermis. The lesions of the skin referred to in onchocerciasis where microfilariae and tissue eosinophilia are usually present also probably represent in especially susceptible individuals an allergic response to foreign protein furnished by either the adult parasite or the microfilariae. The occurrence of cosmophilia in anaphylactic attacks of other origin (Theobald Smith phenomena) is of course well recognized It is also well recognized that the injection of histamine may cause marked constriction of the bronchicles of the lung and give rise to asthmatic attacks and also through its action on the adonomic nervous system may cause a dilation of the arterials and camillaries Also histarmne entering the blood from the tissues may sometimes cause anaphylactic shock

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through the mouth at the time of parturation and bein, withdrawn subsequently Leiper however believes that the worm discharges its young by prolap e of the uterus and that this does not occur through the month but by rupture in t outs de the cir cumoral ring of the papillae that possibly may represent the vagina

Until recently little that was definite had been known about the adult male of the buman spec es. As it had not been discovered in man it was su gested that it dis appeared soon after impregnating the female. A sin le mature male wo m measuring (1006) in Africa fed to a monkey Cyclops containin p esumably infective larvae of

40 mm was said to have been obtained from a natural infection in India while Leiper Dracunculus medinens: Six months later Daniels found within it 5 immature worms 2 males and 3 females These worms were placed in the Museum of the London School of Tropical Medicine but apparently no descriptions of them were published Fairley performed experiments upon 22 monkeys Macacus sin c which we e fed

infected Cyclops but without success

Brug who infected Cyclops with the larvae of the guinea worm fed the e to a gibbon (Hylobales lenerrous) More than a year later the apparently uninfected gibbon was killed and a full grown female Dracunculus was found in the left calf but no male was

Elucidation of the bie bistory of Descunculus medinensis in man resulted par ticularly from successive studies of other species of related parasites which infect ani mals (Ichinyonema sp Ph I metra sp and Drac neulus globoceph I s) In Dracune lus elobe eth ! s which infects the snapmen turtle (Chelvisa se b 4 no) the male parasite bas been found by Mackin (1927-28) It is very small in comparison to the female the largest male measuring mm n length while the largest female was 35 mm. The females were also from two to three times as thick as the males. The male has two spicules The right b at be form of a long ar ow needle and was glways found extruded from the central cone for more than one third of its length. In the female evidences of a varing and ulva in v ne females was detected and Mackin believes it is probable

that the vagina and vulva atrophy in fem le which have fully formed young Strassen al o from a careful study of Philomet gl b p has been able to demon state in the young females a distinct van the ugh very narrow and often detected to the difficulty. His studies of the fertilized adult female in the other hand showed that all traces of the vagina and vulva had d sappeared In young femal specimen be was able to demonstrate an sect in a portion of the spicule of the mile in the vagina

of the female

Moorthy and Sweet (1936-38) have finally been successful in infecting dogs with the human species The dogs were infected by feeding them infected C3clops containing the embryos from man The C3clops were first infected with larvae taken from man by spraying newly opened guinea worm blisters with ethelchloride Moorthy in some to inocula tions was able to infect all six dogs and in these he found 47 male and 181 female guinea worms

The longest female was 53 cm. The maximum length of a male was 4 cm. It is n t worthy that no males were found when the mfect in hid e chid th a e of si m nth He ce it : believed that impreg at on must take place in the early months and that the male subseque thy di ategrates The agina of the fem le contar ed a mucoid pl g when the female had reached 24 cm. As the le gth of th. full grown female in human be go is in the neighborhood of on cm it is evident that in the d g the females bad n t reached the r full g owth With one dob 350 d ys after the first infected feed a temperatule of ou de I ped and a pe sized bli ter appeared above the paw of the left hind f of When open d and sp ay d with ethyl-chloride embryos app ared Other worms showed themselves in other portions of the body. In some of the dogs only females were found a d no males

1380 DRACONTIASIS

Geographic Datimbuton—Infection is still present in Africa, where it studed in ancient times. The endersic centers include the Nut Valley Achiab abolt the interior and along the Red Sea coast Ugunda, centeral equational Africa, the borders of Last Chad the west coast of Africa from Mauritana to Gabun Fersa Turketian India comprising various localities on the west coast especially around Bombay the Central Province parts of the Northwest Province and parts of the Valders Presidency particulty to the west of Madura. Chopira (1946) states that in the eatern half of India it is comparatively rare or about Infection has also been introduced into the inlands of the Caribbean the Gunans and scoording to Campos to a limited area in which Bindl. Themely it was and to be endemine in Cursaco Demental Seamon and State United States (1946) and the Caribbean
Inaganyian

In the United States Chitwood (1933) found reports of 50 cases of infection with Procuredules relefements in man. Pour of these were either certainly are possibly of faceign origin, and 6 neer excess in which infection with this paratite has more of less doubtful. Nevertheless Chitwood points out that a species of Directionless occurring in the for racioon and match in hebraics. I lows New York probably Pennylvana and Ontario is morphologically identical with Draeamedies medianers; a and probably substantial paratite. Reinbrook has also found Draeamedies medianers; in the for in the build States. However owing to the method of trae mission of the disease and the public States. However owing to the method of trae mission of the disease and the public states. However owing to the method of trae mission of the disease and the public states. However owing to the method of trae mission of the disease and the public states of the public disease has a so the public processing the control of the disease and the public states of the disease and the public states of the disease and the public states of the disease and the public public states and the public states of the disease of the disease and the public states of the disease and the public states of the disease and the disease and the public states of the disease and the public states of the disease and the dis

Distribution in the indigenous reason agreem along only indigenous in the indigenous reason and in the indigenous reason are packed in the indigenous reason are represented in the indigenous reason are reason as a part from the indigenous reason are reason as a part of the indigenous reason are reason as a part of the indigenous reason are reason as a part of the population and reason are reason as a reason are reason are reason as a reason are reason as

him (Manson Bahr 1938)

Mirra found that dracontusus occured in about 93 per cent of the population of

Shorapur a town of 15 000 inhabitants in the southwest part of the Varian E Dominion Description of the Parsaute —Drocencular confinents (Lineaus 1358 F. Helbernius mediuters) I Capper 15910 is classified in the authfamily Darcutcutthat (Stite 1591) integral than the major and the sand that family the Capper 15915 In this family the females are commonly larger than the major and the amount of which the product Darautius the parasites have a crephale thield and the vulne 1 minared the group Darautius the parasites have a crephale thield and the vulne 1 minared the product Darautius the parasites have a crephale thield and the vulne 1 minared the product Darautius the parasites have a crephale thield and the vulne 1 minared the product Darautius the parasite have been supported to the product of the parasite has the product of the parasite has the product of the parasite has the

The adult female his es in the subcutaneous connective tissue and at times may invade deeper layers It measures on an averige about a meter in length (75 to 120 cm) by only 1 5 to 17 mm in thickness being a thread like cylindric milky or yellowish winte nematode It is bluntly sounded at the auterior extremity and returned ventrad at the caudal end which serves to anchor at in the tissues. The cuticulum is smooth The antersor extremity possesses a cuticular thickening or oval shield. The minute triangular mouth hes in an eval or quadrate prominence and is surrounded by four pairs of papillac 't pair of lateral cervical papillae is found just behind the plane of the serve ring only a mm from the anterior and The mouth opens directly into the narrow oesophagus which merges with the glandular oesophagus just in front of the cervical papillae The latter is continued into the cylindrical mid intestine which empties by a short conical rectal opening through a very minute aperture often very difficult or impossible to detect. Nearly the whole body of the mature female is occupied by the uterus which is packed from end to end with coiled up embryos. The vagina like the anus also is not distinguishable and apparently becomes obliterated in the mature worm after she has become impregnated and the vulva does not function at the birth of the larval microfilaria According to Louis the uterine tubes open into the posterior part of the oesophagus by a common duct the oesophagus prolapsing

observed that the larvae of Denouncealers re embl those of Guestamus degens a parasate of Perce finesoith and that the nature of partnerson was sensiten in the e parasate in that the larvae can reach the open only after the bursting of the uterus or body of the mother which occurs part citality when contact with water as secured. The embryon mother which occurs part citality when contact with water as secured. The mother of the content of the partnerson of the security of the content of the conte



Fir 324 - Cyclops onta n ng l a f D un ulu m d n n

thought the parasite in indexed Cyclop bored its way through the integement of the body. He did not observe the pa as a of the parasite into the mouth of the Cyclop. However Nybelin has published experiments which also that in a closely all ed species of the geous Pb Hometes Filtras surpunes infection certainly does occur per sain and through the integument of the Cyclops. After ingestion however by the Cyclops the parasite promptly bores its way through the walls of the alimentary it in this the Jody cavity where it is their development occurs. Mowthy (1937) in India has also configned the indiction of Cyclops for or with Discussional size of as it I rave. In the body cavity of the Cyclops codys occurs. The entire metamorphous of the la vae may in soom anisations be completed in from two to twole of days.

Neuve-Lemai e h is the follow g sp c s of Cyclops as sal sfactory for the development of Dr c culus C quad cornus prossurem runds serve lates is c uses b crypt cornul s leuchorit Faust says there are probably other species concerned along

Leiper showed that when an infected Crader is transferred to or per cent solution of hydrochloric acid in other words in artificial gastrejunce it is immediately killed but the larvae are not destroyed and are aroused to greater activity escaping from the Croler's and swimming about freely. It was hence conjectured that under natural condutions man becomes infected through the ingestion of Croler's containing this The larvae of Dracunculus medimensis do not circulate in the blood or lymph in man they remain in the body of the parent worm and are only set free at the time of partuntion usually when the head of the worm is brought into contact with water, or when rupture of the worm may occur in extraction. In clear water they may remain alive for six days, while in middly water or mosst earth they may live from two to three weeks if slowly and partially desircated they may not die but may later be resuscitated by moisture.

The larvae have no boring apparatus or means of passing through tissues or even of entering the integument of their intermediate host Cyclops. They are fillionim meaning 550 to 5500 in length by about 17µ in brendth and more rapidly with a somewhat tadpole like motion. The importments are intermittent sometimes short



Fig 333 -Fresh Dracunculus m of n noss la v e trent d with the finaliv solution of Do mendius larva that to just comit of the occophages B connect portion of the ntre occophage intestinal region of the larva (Aft r Moorthy) (Cou tety Ji of Hygiene)

spasms producing a from like the Greek of alternating with burf passes and straighter ling. The anteener due is blust by rounded and the causal process a long and attended In fixed specimens at may be seen that the ecosphages as bullous and the mid intertue and pope nerve rung and genated promorbum may be recognized as well as a part of and papilles set into deep pockets one on either side of the anal opening. The cutterlam is componently transvertely strained.

Transmission—The method of infection of man is quite different from that of the other Transda described and there is no need host. As the cephalic end of the adult female approaches the human skin a papidle is formed in the dermis which shortly after becomes vensual Shortly after this blister ruptures and if the part comes into contact with water (which it is agit to do as the patient often thrusts the part into water to relieve the burning sensation in it) the head of the parasite is thrust out through the opening of the skin. A prolapse of the uterus of the parasite then occurs through the ruptured anterior wall of the mouth and repeated discharges of motile first stage larvae take place into the water.

The manner of transmission of this parasite to man as well as certain other features of the life cycle was suggested by the study of affect species in fish Leuckart had

observed that the larvae of Drouwcalus resemble those of C culoma elegar a paratte of Prote Jameshir and that the nature of parturnion was rullar in these parastes in that the farvae can reach the open only after the bursting of the uterus or body of the mother which occurs particulty, when context with water is secured. The embryos then estape and it is for from about three to ten days swimming in the water. In decaying in Cycley Proceeding, (8) of act on on the advise of Leuck it introduced be larvae of Drouwcalus into water containing Cycleys the larvae of onests etc. and was able to observe the invasion of the Cycleys by the larvae. Also into the twelfth day the parastes moulted and assumed further development. They could be observed within the Cycle y talk about the fourth week by which time they had grown to a winth the Cycle y until about the fourth week by which time they had grown to a them indeed Cycleys in pain of water failed. Manson, and skio Blanchard confirmed Pedochemics o behaviours in the confirmed Pedochemics o behaviours in the single parastic in Cycley. Fed clenton



rio 324 - Cyclop contan gt e e i Dr cu c iu m u

thou It the parasite in infected Cyclept bored its way through the integration of the body. If edd not observe the passage of the parasites into the mouth of the Cyclept However. Sylvain has published experiments which show that in a closely alticle species through the interment of the Cycleps. After inspectation however by the Cyclept the parasite primpile bores its ** y through the asils of the altimentary it ct into the body carries with the control of the Cyclept. The control of the control of the control of the c infirm of the infection of Cyclept for ear with Deceme 1 are in sense have. In the many in some naturator, be completed in form that the tayle clays.

New Lemant L is the following species of Cyclops as satisfactory for the development of D c neulus C quad co nut pras n s wir dis servical siste us bicush datus coro at s leucharis Faust says there are probably other species concerned also

Leper showed that when an infected Cyclops is transferred to o a per cent solution of hydrodhoric acid in other words an artificial gastric junce it is immediately killed but the larvae are not destroyed and are aroused to greater activity escaping from the Cyclops and swimming about freely. It was hence conjectured that under natural conditions man becomes indected through the ingestion of Cyclops containing this filaria the gastric juice acting on the Cyclops and the parasites in the same way as the hydrochloric acid in the experiment

In order to prove this Leiper fed a monkey on bazaness conceiling Cycles which had been infected for 5 weeks and which contained fully-developed larve. Sur months later when the monkey died 3 worms were found in its connective insues all possessing anatomic characteristics of Discussionis mediscensis. These experiments were reported on 22 monthsys. Vaccus sinuses by Fauley and Clean Listics who failed to confirm this work of Leiper. However Brug has been able to infect a gisbon by feeding it infects by Cycles; and to obtain after a year the adult female parasite. Fauley and Listic had also produced the disease in man in one instance by feeding infected Cyclesy and Moorthy has infected Godes.

The evidence then would appear to be conclusive that man becomes infected by ingesting infected Cyloby in defining water and that the action of the digestive junc causes the larval forms of the parasite to free themselves and to later penetrate the walls of probably either the stomach or duodenum. They then migrate through the tissues where the developed male and female worms come to lodge in the subcutaneous connective tissue. A period of ten to fourteen months is required before the female worms are mature and are teady to discharge their young

While the paucity of male worms has not been entirely explained it has been suggested that after the male fertilizes the female it dies and disappears. However Faust has suggested that it is possible that the females do not even require fertilization to produce viable progray.

CLINICAL AND PATHOLOGICAL FEATURES

The female on attaining maturity travels most commonly toward the legs and feet. It is said to be an conformance with her instinct to seek water. These are the parts of the human body of natives who wear on shoes most likely in tropical countries to come in contact with puddless had sone said that the water carriers in India are subject to guinea worm which in their case is prone to appear in the back, that is, the part of the body against which the water salm hes when being carried. However, in 85 to 90 per cent of the cases the female presents itself in some part of the lower extremities. Occasionally it is observed in the scrowing also rately in the arms or other parts of the body. Rao observed an adult guinea worm in an abscess of the scrottum of a child aged a years.

Rrou found in a case in which the adult worm had produced adenits an abscess of the right inguinal gland. Upon puncture of the gland larvae were found free in large numbers in the aspirated pus. Later the adult parasite was removed from the gland.

Forbers statistics of the point of appearance of the head of the parasite beneath the skin give 7 per cent fees 22 per cent fees 6 per cent amount and hands 4 per cent abdom and wall 4 5 per cent section 3, 5 per cent back and buttecks 1 per cent year and 1 per cent pens. According to I airley in 140 persons who harbored 260 guines abornt the parasite appearant appearant appearant at the surface of the skin with ledge 12 st in the tarms 11 5 in the back in 11 in the butteck in 5 and on the secretum in 4 Charc has reported one instance in which the worm appeared in the todger. Winght observed one case of a calcified

g mea worm in the orbit and Noronha one case in the region of the eyes displacing the eyeball. In the few other instances of reports of infection of the orbit, the parasite may have referred to a different apocies.

Symptoms —During the period of incubation from 10 to 14 months during which time the worm reaches the adult stage there are generally no apparent symptoms. Lane and Low state that in some instances there may be indefinite pains in the limb in which the parasite lies and aching sensations may be complianted of and a feeling as if there was a cord under the skin is also described. The onset of the symptoms usually occurs a few hours previous to or at the time when there are manifestations of the appearance of the worm near the surface of the skin. The prodromal symptoms consist of local erithems sometimes of slight fever and other systemic manifestations especially generalized uriticaria interactioning nausea vomiting and diarrhoea severe dyspinoea asthma like symptoms guidiness and even syncope. These symptoms are

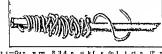


Fig 35-Gun wrm R 11 d n st kf g dult et n (F m G M d 1 Dagn)

believed by Fairley and Liston to be due to touc secretions of the worm which are given off particularly at about the time of its parturition and which are absorbed in the system of the host. These preliminary symp toms may resemble histamine poisoning. They vary greatly according to the susceptibility of the patient The localized lesions usually become evident a few hours after the onset of the systemic symptoms but at times they are coincident with them. Especially when the head of the worm comes to the surface or points an itching burning boring or dragging sensation is experienced at the spot pressed upon. If the patient has before harbored a guinea worm that has been removed be can usually tell when the worm is coming to the surface. A small group of papules or a single one usually now become visible and gradually in the center of this area the epidermic becomes elevated and a small vesicle forms. The inflamed area increases somewhat in size during 24 to 48 hours. The irritation produced often causes the patient to immerse his foot in water This vesicle and its margin which gradually becomes more indurated may cover an area of from mm to 5 or 6 cm in diameter Later on the blister if not opened usually ruptures dis closing a small erosion and a small perforation large enough to admit an ordinary probe is visible. Sometimes the head of the worm is seen protruding from this opening If this is not so and the opening is douched with a stream of cold water expressed from a sponge in a few seconds a drop of somewhat milky fluid often exudes and flows over the surface

Sometimes instead of this fluid a small tube which is the uterus of the parasite may be projected through the hole in response to the stimulus of the cold water. Apparently in this act the tissues of the head are often ruptured. When the uterus of the parasite has been extruded about an meh it suddenly fills with an opaque whitish material ruptures and collapses the fluid spreading over the surface of the erosion. If a little of this fluid is placed under the microscope at is seen to contain myriads of Dracusculus larvae and if a drop of water is added to them they may be observed to snim actively about If the wound in the patient is again douched with cold water after an hour or so a fresh supply of larvae can be obtained and this process can be continued from time to time until the worm has emptaed herself. Apparently the cold water applied to the skin stimulates the norm to contract and thereby forces out her uterus little by little until it is completely extraded C

The toxic symptoms usually subside upon rupture of the vesicle and the appearance of the head of the worm in the hase of the lesions. How ever following this the region around the worm often becomes extremely painful inflamed and oedematous and cellulitis due to secondary bac terral infection may result. Some of the cellulitis may be due to the excretion of towns by the mature parasite as Fairley and Liston found from experimental laboratory inoculation of animals. However in their study of 218 human cases they found that all the more serious complica tions are connected with secondary bacterial infection. In 71 per cent of the cases the blister had ruptured at the time the patients presented themselves for treatment and in 43 7 per cent septic complications were already established. Nevertheless they also encountered aseptic abscesses which in some instances they believed were caused by the embryos of the parasite

Botreau Roussel and Huard have likewise described non hacterial inflammation around joints and have emphasized the aseptic character of the purulent material in a series of cases of infection with Dracunculus complicated by synovitis They emphasize the disturbances of the knee joint that may occur from the presence near it of Dracunculus Pain redness and swelling often occur in the region of an invaded joint with

later effusion

Pradhan points out that in India near Bombay in 23 per cent of the cases of Dracunculus infection a joint is affected (generally the ankle) which often leaves a persuanent and crappling condition Journe reports a case of septic arthritis of the right knee joint while the skin was intact The joint was incised and cocci were present in the fluid. A month after the primary incision a guinea worm presented through the wound having presumably been instrumental in introducing the bacteria Later ankylosis of the knee joint followed

When the worm presents in the lower part of the leg or foot the part usually swells more or less and becomes red and tender and nalking becomes ampossible Bauvallet states that in north French Africa dracunculosis empples about 7 per cent of young porters

Desper issues caused by the parasite and secondary infection from staphylococci and streptococci which semicinise ensure produce conditions such as looghing of the tendens perio tits necro is of the bose gangeries and general septicacina from which death may result. Lang and Low report cases of the norm passing into the sections who is discussible may be set up and if the bacterial infection is superadded sensor equidyingiate and orderins with ulimited electrician of the testides may occur. They count out that if the parasite comes meaning and the testides may occur. They contribute the parasite comes in the parasite parasite of the parasite comes and the parasite paras



Fig 326 -P maleg nea w rm lying under th & n f th f earm (By perm) s f om M neo Tr p 1 D es u)

the tumors was f llowed by the child's death. In the center of the tumor the coiled adult worm was found

In some instances the worm fails to come to the surface and pierce the integument or it may due before reaching, malarity; if no sepsas is associated it may become absorbed or calcified and in some instances be felt as a hard cord beneath the skin or an absects may result. In other instances the cal ified worms may give re to scattera synovitis and persositists.

Diagnoss — Diagnoss may only be possible when the adult parasite presents itself at the surface of the skin. In other instances it has occa usonally been made when on opening abscesses a complete adult parasite or portions of one has been encountered. In aspirating an affected joint the larval forms an sometimes found in the fluid removed. Lester found in one matance an entire adult nariosite contained in a hermal size.

Roentgenograms may be of service in detecting the location of the parasites particularly when they are effete or calcufied and their presence in the part is suggested Injections of bipsoids or collargol into the norm renders it opaque and often its exist position in the issues may then be determined by subsequent skingraphy. Essimpoids of varying degree is usually present in the blood. Lane found that is per cent was average count. However in some instances of infection there has been no increase in the commonlishe in the blood.

Ramsay (1935) has employed the intradermal test for discontiasis using the saline extract of the para ite. He reports that 47 6 per cent of the persons gave a positive reaction. However, some of the positive reactions occurred in persons who declared that they had never been infected with guinea morm. Ramsay failed to produce an

antigen which gave a satisfactory precipitin test

Prognosis — The prognosis on the whole is good Frequently only one Dracunculus is present and if it is carefully removed there is often no further trouble. However, multiple infections are not uncommon



Fig 327 -Dracont as a passent the bi sier is seen just forming near the ank! (After Moorthy) (Cou tesy Journal of Hygiene)

Faciley and Liston found the average number of worms per person was 10. Bayusi let found that infection was generally emiliple in Afreca and in one instance the path had suffered at intervals from infection with 30 of the adult worms. Core who in Hong Kong observed it cases which had contracted the infection in India found that ic had plural infections. 3 worms were removed from one man is whole and 3 broken. Cellustias and abserves developed in three three. Full-born says that cause in which few norms have been preprient at one time are now ever trans.

When serious sepais has occurred the results may not be so good and when the part sites are located near the souts permanent deformaties often result. Pradhan who found to per cent of the Coloba District of Bombay suffering yearly from gunes worm infection found that in 23 per cent a junt was affected leaving a permanent and crip

pling condition so that the economic waste was considerable

In a number of countries the amount of temporary disability caused among troops has often been very serious. The lesions are aggravated by marching and by the use of the limbs. In many instances the men are incapacitated for mulitary duty until the parasite has discharged her larvae and the lesion has healed a process which takes on the average about a month.

The danger of reinfection in endemic centers is also often great Moorthy points out that in the Chitaldrug District in Mysore India, of TREATMENT 1,89

1363 sufferers from dracontiasis in one year 1144 had previously been infected

Treatment—As soon as the detection of the guinea worm has been made by its appearance at the surface of the skin it is advisable either to place the patient in bed or to obtain rest for the affected extremity or part. Much of the disturbance, that results is sometimes due to the fact that the patient continues to use the lumb which factors so elling and other inflam matory changes and hence secondary infection with bacteria.

When systemic symptoms are present with urticaria pruntis dysphoea and hausea the administration of adrenalin may give relief

Probably the most successful method of treatment is the one practiced in ancient Bblical times modified by our improved knowledge of the habits of the parasite and the value of antiseptic treatment. If seen before it has ruptired the bluster should usually be opened asspitically with ecssors and any necrotic skin around the opening excised. If the guinea worm is protected from injury and the part occupied frequently douched with water often the uterus will be gradually forced out and emptied of embryos. Until this process is completed the worm resists extraction and the hook at the end of the tail assists at to maintain its hold in the lesson. When parturation is completed generally in from 15 to 50 days the worm is often gradually absorbed or tends to emerge spontaneously.

Duning they rocess of partention of the sorm the les on should be covered with a Duning they again they most with sterles acts and covered with procedure robbet. The dressing should preferribly be ten weed to ectally and cold system to proceed on the hand have and around the lesson to hasten the death as of the last the worm protructs sufficiently from the opening a small piece of a lik thread should be tated to it and the end of the sorm statested by the thread to a small piece of handloop other wood. An attempt should then be made to extract the worm by obtaining shight traction through making a turn or two of the six of daily. Care should be taken not to exert much force or to withdraw the some no soon as the worm at able to impure and inflammatory behangs and cell list then generally result. It is on account of his dail age of rupture of the parasite that some physical shave advised abandonment of tha old method of extract on.

If however the extraction is perf rmed slowly the results appear to be more satis factory on the whole than with other methods of treatment However Moo thy (94) who has had experience du ing ma y years in treatme t says that this old method is the one which s still employed in most of the villages. In many localities there is still used the appl cation of cold poultices made from the tender b mboo shoots. It has been observed that when this poultice is applied after open g the blister the worm s induced t d lodge itself from the t ssues and issue from the skin opening a d liberate the larvae in enormous numbers into the poult ce. The ad a tage f this method of the the application of only a cold pad r supplying the effected part w to ethyl chlorid is that the libe ated larvae are mm diately killed by the hydrocyanic acid and another t xic pluc pl found to be present in an aqueous extract of young bamboo shoots Bauvallet ho has employ d the old method m a routine way go s th average dura tion of such treatment as twenty three days The I ngest time was 73 days and the sho test (upon an opiative c se) ir days. In this one oper tive c se- a patient wh h d pre ously had 7 pa tes extracted from his le s-the eighth Dracuncul s pre s ted itself in the sk no er the th ray at the level of the eighth rib The parasit was extracted whole the gha wid a cision and carefild ssection. Bauvallet points out that this meth d of treatment is not rec minered d in ge eral and should be applied uly m a ca e where the parasite is well calized and c iled about itself. This method of s ig cal treatment howe er sh rt ed the time of indisposition of the patient to

o ly 1 days

A number of authors have suggested surgeral dissection of the worns. Entley and Liston have excommended that after the parasite has been located by making it promoted and palpable by applications of see or elbyl chloride, which is said to induce contraction of its musculature? For 3 small incursons are made across and over the land of the worm loops are pulled out with a standards based has the precent withdrawn through these openiors and the sinus, the latter after extraction of the pieces being disnifected with a 7 po carefolic solution. However, they advise actual excission of the worm when it have convoluted in a limited space, but if this is not the case they recommend intermittent traction combined with massiver.

A number of drugs have been recommended to destroy the parasite. Mache Fairley and others have employed injections of tartar emetic intravenously Jeanselme and Montpellier novarsenobenzol and Chaigneau and Tournier Lermas (term) treatment have little value. Others have successed insection of the norm with chloro form or cocame to order to kill it. Injection of perchlonde of mercury directly into the worm has also been recommended for the purpose of destroying the parasite or rendering it sterile. The difficulty of this method bes in inserting the point of the needle into the body of the worm and even if this is done one cannot be sure that the fluid will penetrate the entire length of the worm Lane and Low state that in their experience the method has not proved successful the older one of winding the parasite about a stick having given better results. Moorth's (2012) states that injections of perchloride solution in a strength of a 1000 have been reported to give good results in parts of India but it has been difficult to persuade the majority of the villagers to adopt this method on account of the severe local pain and arritation caused by the drug. He recommends instead injections of acrifiavia solution t 1000 which he states is used with success in certain cases. This drug appears to have some advantage over other preparations. An local pain or irritation is produced nor does it give rise to any other systemic disturbances On the contrary it seems to give immediate rebel to the local itchiness and biting pain so frequently complained of Neither Bauvallet or Morard (1035) recommend the method of injecting the paramie to destroy it Nevertheless Elliott (2942) believes injections of phenothinzine is very satisfactory if the injection is given hot and care fully watched for toxic symptoms

tuly watched for toxic symptoms. We have a conclusively demonstrated the Mercover Districts Romale and the have been employed for this purpose. He has found that the same employed for this purpose. He has found that the purpose and the same employed for this purpose. He has found that the purpose and the same employed for the purpose and the hard that the proposers are desired in the text of the same showing the location of the worm may semestimes be obtained (see Fig. 379). Their andors and show that the worm is present in the connective these and most the muscles. Hudellet has suggested upertions of colleges in order that the worm may be located by contigen mys and then dissected out. However Botreat Rosses's excellent contigenograms of a number of cases show that such a procedure on account of the soft may be contracted to the contract of the soft may be a supposed to the soft may be dear in many manner.

If cilibius has already occurred when the patient comes under observation street rest must be enforced and notive the functions such as 1900 or arbible solution a strength of 1 so should be freely applied. If the cellulatin is sever and shows a tendency to spread wromen should be made and if there is put it should be freely supated. Albertses which may form in the breast as well as an the extremittes should attend the contract of the contra

also be freely opened.

The condition of the gounts may sometimes require surgical treatment. Bottraw
Roused and Huard have emphasized that appration of the joint and removal of the
sterile pays is an many instances all that is required. However Lake and fore state that
in the more servicus cases the indection may be such as to require opening and draming

of the joint and perhaps even excision

During convalescence the himb should be used with care. In a few instances calcified worms may give the to scatter a and in such instances surgical removal after renesten tay demonstration may be advessible.

For the treatment of distressing prodromal symptoms such as utilearia and asthma which may be due to the absorption of toxins from the worm

Fairley and Liston have found that subcutaneous injection of about no minims of a 1 1000 solution of adrenalin hydrochloride immediately relieves such symptoms



Fig 3 8-D s s l med t s O n wenn t ction n I da by th nat ve method f wnd ng ounda t p f b mb



Prophylaus—Infection occurs only by drinking water containing infected Cydops In India the wells approached by steps are the great source of infection and in Africa the ponds in the neighborhood of villages

Prophylactic measures should include (1) Prevention of the larva of Dracunculus from reaching the water from wells by problibting the dissing of water from wells by those infected with the parasite and by comparing of the lesion in which the worm is present by a surgical dressing and the subsequent destruction of the dressing. The nells and tanks approached by steps and the other sources of water supply where individuals are able to stand in the water when obtaining the drinking supply should be abolished as soon as possible and instead arressan wells should be substituted where practicable and these and other wells provided with pumps rather than with buckets for drawing water.

(2) The killing of Cyclops in the wells Leiper found that this might be effected in 6 hours in a well containing a thousand gallons by ficating the water from 15 to 65°C which implies the running into it during six hours of the steam obtained by the vaporization in a boiler of 87 gallons of water and the consumption of 87 pounds of coal. However, Regrets has pointed out that this treatment would have to be performed.

weekly and that the expense in India at least is prohibitive

Atlling of Cyclops in water has also been recommended by the intro duction of chemical substances especially such as caustic potash (Alcock) permanganate of potash (Turkhud) and lime 80 per cent CaO (Pradhan)

Dass found in abbotatory expeniences that caustic potable blesching powder potassium permangiants quote him and ablastic line as well as several other autoations in a pil of 10 or note was lethal in all cases to the Cyclopt. A convenient method of treatment of the water was successed by adding quick line or ordinary line in the solution of 1 roos. Protham found in principal use that Cyclopt lived for 4 hours me potassium per mangianta a oz. in 1 coop gallons of vater and points out that such water is undentable. Lime 80 per cent CaO in a strength of direction to the guilon was used by removing water from the well and returnate the water with the require amount of hime dissolved in it. The water was potable in two days. The process had to be repeated every fortinglis as the Cyclopt appreading again after that period. In two vidings in which the wells were so treated a slight favorable effect was obtained in the action of the number of infections of the village which used the well. Most other has found that perchlorion in combination with copper anghate section of all the distinctions from the contraction of the other of the contraction of the other little segregation of the Cyclopt appears as effectively as they detery daint with the result that Cyclops invariably respect in the well within a month or two of creatment.

Moorthy and Sweet have suggested for the biologic control of the disease the introduction of fish Barbus puckells. The fish are added one month after treatment of the water with perchloror. This fish has been introduced experimentally into some of the step wells in India Laboratory experiments have shown that this speces of fish feeds vora crously not only on Cyclops but also on the guinea worm larvae. In certain endemic centers in India Liston and Turkhud found 37 per cent of the Cyclops infected.

Pradhan points out that since guinea worm disease is seasonal in India the great mass of infections occurring between February and Vay the use of time for the dis infection of wells to prevent contamination of the water by acute cases need only be carried out during this period of the year.

(3) For personal prophylaxis obviously boiling and filtering the drinking water is efficient for the destruction of the larvae and for prevent ing the infection As the Cyclops are just visible to the naked eye straining the drinking water through coarse calico such as villagers use for clothing has been suggested by Rogers as the simplest and most practical method for them to avoid infection

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the antenor extremity and a ventral sucker or acetabolium. The intentional tract consists of a pharyer proceeding from the onal sucker which bifurcates and terminates in z bit d intestinal case. In the Semirocoularomae, the branches remite to end in a sig decision. There is no anas. The exercitory system is bilaterally symmet incal and open at the posterior end of the body usually on the dorsal aspect. It consists of numerous scattered clasted flame cells from which mutuel enablicular or. These unite to form z collecting ducts which yo a posteriorly in the exerctory year is

The remodistive of man are a transfer complexed. In a few species like the human blood finises the eve are separate but the great mannity are hermaphord to On the male sade of the system there are usually a tester wish chivary greatly in shape and position in different families. From each a vas effectives area and these unite to form a vas deferens. This shickbarges at a gent all pore situ ted usually ventrally near the bifurcation of the get in frost of the ventral sacker. The terminal part is often mod field to form a musicals copulatory organ the curries. In the female system there is a single owary from which the owded crasses. This gives of a branch which ends blandly in a receptoculum semina but which may give off a secondary branch (Laurer cannil) which open circurally on the dorsal surface and it believed to take c re of the o erflow? In the owd ct. The ownster proper in which fletilustion continues forwards at the sterms. The sterms ignating the own which is common general to the common genual poe. The term and part functions as a wagne at the beginning of sexual activity but after the uterus becomes filled with a a conditions seem misson of sexual activity but after the uterus becomes filled with a a conditions seem misson.

Classification—Flukes are divided into two subclasses (s) the Monogenes in which the egg press rus to a tarm which becomes an adult without an intermediate host and (s) the D goes in which the large first becomes paramite in some intermediate its (molliucan) boat and there gives use to subjectionit generation of larvae of which some final stage develops into adults in the vertebrate boat either directly or after having even the directly of the control of the directly of the stage of the stage of the directly of the stage of the st

pa assitic in man helong to the latter subclass

The three important superfamilies of flukes parasitic for man are

r Paramphistomoidea—flukes with two suckers one situated at each extremity. This includes the genera Gast ode cust and It associates.

2 FASCIOLOGEA—dukes with two suckers one terminal the other posterior to it and situated ventrally. This family includes the important genera Fosciolo Opis thorchis D occidium Fasciologis Paragonismus Clonorchis Hel phyes Metagonismus and Ethinoritoma.

3 SCHISTOSOMATODEA—flukes in which a leaf bke male by an infolding of its sides makes a channel for the thread bke female. The se es are separate not united in a he maphrodutic worm as they are in the Fasciologides and Paramobistomodes.

KEY TO THE IMPORTANT TREMATORES PARASITIC IN MAN Superf muly Fasciolomea Hermaphroditic Eggs Ope culated Ge tail pore anterior to acctabulum

1 Plukes manute with a thard (great I) sucker
Flukes medium name two sucke eggs in sputum and face:
1 Intestine of indendrite
2 Testes anterior to uterus
T stes poste or to uterus
Der coelism

4 Testes br ched 5
Testes I b dore tre 6
Flukes about 4 t 7 cm lang eggs 150µ Fasc lopius

5 Flukes about 4 t 7 cm long eggs 1504.
Flukes about to 2 cm long eggs 3 p Clono char 6 Flukes about r em nori g of 830 nes eggs 304 Op sthorchus Flukes 2 mm nori g of 830 nes eggs 304 Mctater mind

Chapter XLVII

DISEASES PRODUCED BY TREMATODES OR FLUKES SCHISTOSOMIASIS

Zoological Considerations —Flukes are non segmented flat worms, usually leaf like in outline, rarely cylindrical. They are characterized by the possession of suckers by means of which they attach themselves to the skin mucosa or other tissues of their host. With the exception of the Sciunstonounicological all flukes are hermaphroditic and their eggs

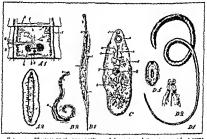


Fig. 330 — Hustra to showing antonical d incitors betwe in a ces of a petint is de a trematod and one of the Acanthoc-pland. At Ten as 20 (1 Teste 2 Yook glands 3 Shell glands 4 Owares 5 Vagena 6 Vas d feren 7 Utrus A Cross set nord size B Female Fart but 1 Vulva 2 Oyary 3 Bullo couple again 4 Annis Bis Male Entrobasis Oscaphageal Inflation C Fe coolegis but it Torla ucker 2 Aca tabulum 3 Uternia 4 Circu pouch 5 Intestines 5 Ook glands 7 Ovary 8 Shell gland 9 Teste D x x 3 Worm head and agg of Microsc n the byth such interfal access.

are operculated (provided with a lid) The only other operculated eggs met with in human infections are those of the DIPHYLLOBOTHRHIDAE of the class Cestoda

Morphology —These parasites vary in size from those just visible to the taken eye like Helcophyres and Medicommus to large fleshy species like Pascade and For 100'09 is "The most characteristic raternal structures of the falses are the acetabula or suckers. Flinkes of medical importance have a suckers which except in the Pasartimistorous are quite close together and all sucker surrounding the mouth at provided with eye spots exerctory flame cells and secretory cells or eg in the sheep liver fluke with a solid organ the proboscs at its anterior extremity. It escapes from the shell either by rupturing it or by forcing open the operculum

The eggs of Sch st oma hatch soon after the excreta are diluted with water but in the case of Opisikorchis and Het rophy s only after ingestion by an appropriate

molluscan host

In the case of Schistosoma Fasciola Fasciolopsis and Paragonimus the miracidium assumes for a short time a free swimming existence but 1 unable to take nourishment Within about 24 hours it either finds an appropriate gastropod mollusean host (a s ail) or penshes The molluse thus constitutes the first intermediate host. In the ease of Obisthorchis and Heterobis x the ova hatch only in the ocsophagus of the appropriate s ail after they have been a gested in the egg stage. If the appropriate mollusc is present in the vicinity of the f ee mirac d um it is attracted by the fluid discharged by the molluse and attacks the tentacles of the snatl by means of a lytic substance formed by the secretory cells it penetrates into the soft ti sues and makes its way to the lymph spaces around the d gestive glands at the inner tip of the shell. It then loses its ciliated epithelium and in the course of a few days becomes greatly modified becoming a simple elongated sacculated form without mouth or other distinguishable external or internal structures It is now called a first generation sporocyst. The latter enlarges and the cells in the sporocyst wall problerate to form many discrete masses which develop into red as the third lar al stage. The reduce are eventually liberated by rupture of the sporocyst and make their way into the liver of the snail where they undergo further development. The young reduce are minute but they may attain a length of 2 mm in the case of the liver fluke. They are also elongated sac like structures but are characte ; ed by possessing a s mple bh d alimentary canal and a collar like constriction near the anter or extremity Within the body of the reduce for a time a seco d genera tion of young reduce may develop and escape through a birth pore behind the collar Eventually there develop a ithin the body of the red as numerous cercarius the fourth larval stage. These are minute worms resembling the adults in having a leaf like body provided with two suckers and a hisurcated intestinal canal shaped like a two tined fork. They differ in having a lo g slender tail which in the Schistosouatoidea is forked The visceral mas of the sna ! in the course of a few weeks becomes densely packed with these larvae which are continually discharged throughout the life of the s all Faust (1934) working a th S manson in P erto Rico found that a s a l nfected with a single miracid um might libe ate 100 000 to 250 000 cercariae

The cricamae leave the mollage and swyn about in the water. In the case of the huver flute they plose their tails craying pladees of gress and become energyted or encyts on the water. Here they remain use I the grass is extens or the water is domit by a abeep or other water ble definitive bost. In the case of the exhibitorismes the few laving errangementrate the subtroken kin or busical musous membranes and after a m grainon through the blood stream come to rest in the portal system where the partiaster seach institutive.

Honever the majority of the hermaphrodite trematodes make use of a second intermed at host in which they enjoys? Thus $Fass \delta$ is enjoyit and use intuitions Ech is stime enjoyits in a second molluscan h at Cl moreks Op is bc in and Ilste ophy; enjoyit in the uses of frenho a stall variet falses while Pa enjoyits in the uses of frenho a stall variet falses whe IP a gow many encours in this host which serves namely to protect and transport the parase to encurs in this notes which serves namely to protect and transport the parase to the transport of the entering such a host loss the c tall periodical in the transport such a host loss the c tall periodical in the transport such as I and I and I and I and I are the I and I are a such a I and I are the I are the I and I are the I are the I are the I and I are the I are the I and I are the I are the I are the I are the I and I are the I are

Whether the multiplicative process of the trematode within the molluse is asexual or bisexual is disputed (Stunkard 19,6)

Molluse Hosts—In those trematode infections of man of which we know the life history some species of molluse serves as an intermediate host. The phylum Mollusea includes unsegmented animals usually

Superfamily Schistosomatomea Sexes Separate Eggs 150µ terminal spine in urine (rarely faeces) Eggs 150µ lateral spine in faeces (rarely urine) Eggs oou minute lateral knob in facces

Eggs Not Operculated Schistosoma haematohum S manson S зафольсит

CONCURRATION OF THE PLATAMETRINETIES (From Monach

	VIION OL THE LIVE	LABETMIAINES (FLAT WORMS)
Class Trematoda			
Superfamily	Family	Genus	Species
Paramphistomoidea	Gastrodiscidae	Gastrodiscus	G hominis
* wiampinstonioided	l Paramphistomidae	Watsomus	W watsom
Fasctoloidea	1	(Fasciola	Γ hepatica
	Fasciobdae	Tasciolopsis	Γ buskl
	l	7	(P ringeri
	Troglotrematidae	Paragonimus	P westermani
	1)	P compactus
	/	Trogiotrema	T salmincola
	Lchinostomatidae	Echinostoma	E ilocanum
	ì	(Opisthorchis	O fehneus
	Opisthorchiidae	Clonorchis	C sinensis
	Heterophyidae	Heterophyes	II beterophyes
		Metagonimus	M yokogawai
	Dicrocochidae	Dicrococlium	D lanceatum
Schistosomatoidea	Schistosomatidae	Schistosoma	S haematobium
			S Japonicum
			S mansoni
			S intercalatum
Clasa Cestoda			

asa Cestoda				
		(Diphyllobothrium	D	latum
Bothriocephaloidea	Diphyllobothiudae	Diplogonoporus	D	grandis
	Davameidae	Davamea	D	madagascariensis
	Dipylidndae	Dipyhdium	D	caninum
	l		(If	diminuta
Taemoidea	lfymenolepididae	Hymenolepis	н	nana
	}	(Echinococcus	È	granulosus
	l) (T	solum
	Taenudae <	Taema <	т	sagmata
	Anonlocenhalidee	Restuella	R	etuden

Note -Tuo larval Taennidae are found in man (Cysticereus cellulosae and Echinococ cus granulosus) also tuo larval Diphyllobothriidae (Sparganum manson; and Sparganum proliferum)

Life Cycle - In the process of development from avum to adult fluke the organism passes usually through four larval stages However there are only 3 in the Scuisto SOMATOIDEA. The ova are laid in the lumina of the hosts organs or in the tissues where the adult worms have and directly or indirectly they reach the exterior. In the case of Fasciola Fasciolopsis Clo orchis Heterophyes Schistosoma mansons and Schisto soma japonicam this is accomplished in the faeces while Sel istoson a hematobium is usually eliminated in the urine and Paragonimus in the sputum. The eggs passed in the facces are composite ie the ovum proper is surrounded by yolk cells necessary for its nutrition during development. In some species segmentation is well advanced when the eggs are passed In others it does not begin until the eggs reach water and then if the temperature is favorable and oxygen abundant segmentation occurs This results after 3 to 6 weeks in the development of the fully embryonated egg which encloses the first stage larva or muracidium. The miracidium is a minute ovoid ciliated embryo without ao alimeotary canal and with only a primitive hody space but

provided with eye spots excretory flame cells and secretory cells or e.g. in the sheep liver fluke with a solid organ the proboscis at its anterior extremity. It escapes from the shell either by rupturing it or by forcing open the operculum

The eggs of Schi tosoma hatch soon after the excreta are diluted with water but in the case of Opuskerchis and H terophyes only after ingestion by an appropriate

molhu-can host

In the case of Sch tosoma Fasciola Fasciolopsis and Paragonimus the miracidism assumes for a short time a free swimming existence but is unable to take nouri himent Within about 24 hours it either finds an appropriate gastropod molluscan host (a snail) or perishes. The molluse thus constitutes the first intermediate host. In the case of Opisthorchis and Hete ophyes the ova hatch only in the oesophagus of the appropriate snail after they have been ingested in the egg stage. If the appropriate molluse is present in the vicinity of the free mirac dum it is attracted by the fluid discharged by the molluse and attacks the tentacles of the nail by means of a lytic substance formed by the secretory cells it penetrates into the soft tissues and makes its way to the lymph spaces around the digestive glands at the inner top of the shell. It then loses its critated epithelium and in the course of a few days becomes greatly modified becoming a simple elongated secrulated form without mouth or other di t nguishable external or internal The latter enlarges and the structures It is now called a first generation sporocyst cells in the approcyst wall p obserate to form many discrete mas es which develop into reduce the third larval stag. The reduce are eventually liberated by rupture of the sporocyst and make their way into the fiver of the snail where they undergo further development. The young reduce are minute, but they may attain a length of a mm in the case of the it or fluke. They are also clongated sat like structures but are characterized by possessing a sin ple blind al mentary canal and a collar like constriction near the anterior extremity. Within the body of the reduce for a time a second general tion of young reduce my develop and escare through a birth pure behind the collar Eventually there develop within the body of the reduce numerous cercarius the fourth larval stage These are minute worms resembling the adults in having a leaf like body provided with two suckers and a bifurcated intestinal canal shaped like s two timed They differ in having a long slender ta I which in the Schizzosomatoidea is The visceral mass of the snail in the course of a few weeks be onces deniely packed with these I rose which are continually discharged throughout the life of the small Faust (1014) working with S manion in Puerto Rico found that a small prected with a single muracidium might liberate 100 000 to 250 000 certariae

The cercarae leave the molluse and sum about in the water. In the case of the liver fluke they lose their tails grawl up blades of grass and become encysted or eneyst on the water. Here they remain unt I the grass is eaten or the water is drunk by a sheep or other suitable demnitive host. In the case of the 5th tosomes the free living certariae penetrate the unbroken skin or buccal mucous membranes and after a m gration through the blood stream come to rest in the portal system where the parasites reach maturity

However the majority of the hermaphroditic trematodes make use of a second intermediate bo t in which they encyst. Thus Pascaole encysts on v a tation in aquatic situations Echinosioma encysts in a second mollu can host Clo orchis Obishorchia and Heterophyes en yet in the tissues of fresh or salt water fishes while Parag it mus encysts in the s it tissues of crabs and erayfishes. No multiplication of the paras te occurs in this bost which serves mainly to protect and transport the parasite. The cercarme after enter ng such a bost lose their tails penetrate into the tis ues and encyst but they may undergo further growth and development into met ce carrie as in Pa agonisms The paras to then hes dormant until the host is eaten by a suitable definiti e host. Consumption of the e second int rinediate hosts either raw or made quately cooked offers a means of a fection for a definitive bo t as man

Whether the multiplicative process of the trematode within the molluse is aserual or biserual is di puted (Stunkard 19,6)

Molluse Hosts -In those trematode infections of man of which we know the life history some species of molluse serves as an intermediate host The phylum Mellusca includes unsegmented animals usually

Superfamily Scitistosomatomea Sexes Separate Eggs Not Operculated Eggs 1504 terminal spine in urine (rarely faeces) Eggs 150µ lateral spine in faeces (rarely urine) Eggs 90µ minute lateral knoh in faeces

Schistosoma haemotobium S mansant S sabonicum

CLASSIFICATION OF THE PLATTHELMINTHES (FLAT WORMS) C

Class Trematoda			
Superfamily	Family	Genus	Species
Paramphistomoidea	∫Gastrodiscidae	Gastrodiscus	G homines
	Paramphistomidae	: Watsonius	W watsoni
	1	(Tasciola	Γ hepatica
	l'asciolidae	[Fasciolopsis	l' buski
	.	(_	P ringeri
Fascioloidea	Troglotrematidae	Paragonimus	P westermani
)	i_	P compactus
	<i>ŧ</i>	Troglotrema	T salmincola
	Ethinostomatidae	Echinostoma	L ilocanum
	1	Opisthorchis	O fehneus
	Opisthorchiidae	Clonorchis	C sinensis
	77-1	Heterophyes	II heterophyes
	Heterophyidae Dicrocoeliidae	Netagonimus	M yokogawas
	Dicrocoeliidae	Dicrococlium	D lanceatum
Schistosomatoidea	Schistosomatidae	Schistosoma	(S haematohum
)S Japonicum
			S mansons
			S intercalatum
llass Cestoda			

C

			w	interchiatum
lass Cestoda				
	Diphyllobothmidae	(Diphyllobothrum	D	latum
Bothmocephaloidea	Diphyllobothmidae	Diplogonoporus	D	gtandis
	Davameidae	Davamen	D	madagaseanensis
	Dipyhdiidae	Dipyhdium	D	eaninum
		P	Π	diminuta
Taemoidea	lly menolepididae	II) menolepis	111	Dana
Tacmolden	}	(Pchinococcus		granulosus
		,		solium
		Taenia •		saginata
	Anoplocephalidae	Bertiella	В	studen

Note -Tuo larval Taens dae are found in man (Cysticereus cellulorae and Echinococ cus granulosus) also tao larval Dephyllobothresdae (Sparganum manson; and Sparganum proliferum)

Life Cacle -In the process of development from ovum to adult fluke the organism passes usually through four larval stages. However there are only 3 in the Scripto somatoldes. The ova are laid in the lumina of the hosts organs or in the tissues where the adult worms live and directly or indirectly they reach the exterior. In the case of Fasciola Fasciolopsis Clonorchis Heterophyes Schistoso na mansoni and Schisto soma japonicum this is accomplished via the faeces v hile Schistosoma hemotobium 19 usually eliminated in the utine and Paragonimus in the sputum. The eggs passed in the faeces are composite te the ovum proper is surrounded by yolk cells necessary for its nutrition during development. In some species, segmentation is well advanced when the eggs are passed In others it does not begin until the eggs reach water and then if the temperature is favorable and oxygen abundant segmentation occurs This results after 3 to 6 weeks to the development of the fully embryonated egg which encloses the first stage larva or muracidium. The miracid um is a minute ovoid calcated embryo without an alimentary canal and with only a primitive body space but

Bulinus the principal host of S haematob um has a short spire with a pointed apex and a sinistral opening. It is found in canals and ponds. The shell of Physopsis is smular

Oncomelanta (with ribbed shells) and K tayama (or Blanfordia) (with smooth shells) the hosts of S saponscum have slender tapening shells 5 to 12 mm long with many whorl and a pointed aper There 1 a coarse ridge on the external surface of the sharp outer hp They are amphibious and operculated

Experimental infection of snail by muracidia show that these tend to avoid unsuit able hosts and attack only certain hosts. Many miracid a however attack snails which are not efficient hosts and undergo partial development. Various species of a genus (but not all) may act as hosts Mollusc hosts are n t so restricted in their range of parasite or the flukes so restricted in their range of hosts as they were formerly thought to be

SCHISTOSOMIASIS PRODUCED BY THE HUMAN SCHISTOSOMES OR BLOOD FLUXES

The most important of the flukes which are parasitic in man are those which are found in the blood vessels. Such infections are exceedingly common in Egypt and in certain areas in the Orient and occur in many parts of tropical Africa and South America. The disease is commonly called schistosomiasis since the human parasites all belong to a common genus Schistosoma Weinman (1858)

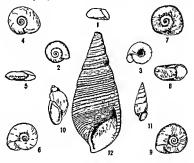
Morphology -The schistosomes differ from other flukes in many respects They are dioectous (sexes separate) instead of hermaphroditic There is no pharyn: The gut branches reunite to form a single caecum
The eggs do not have an operculum In the larval stages asexual multipli cation occurs only in the sporocyst stage no rediae being formed. The cereariae have forked tails but no pharynx. They penetrate the unbroken skin or mucous membranes by means of a lytic substance secreted by the single celled cephalic glands and do not require a second intermediate host

The males are from about so mm to 20 mm long The anterior fifth of the body is cyl drical but the posterior four fifths is flattened and thin. The margins however are infolded ventrally to form the gynaecophone canal in which the female is enclosed during copul t n or aft r sexual maturity is reached. The small testes are grouped just behind the ventral sucker. The female is bout 20 to 26 mm long filariform and darker in color the the m le. Both extremities project from the canal of the male

which she les The ovary lies nterior to the union of the gut branches

Life II st y - The flukes h e in the portal vein and its branches From the study of human inject one and the more recent observations of Fai lev on hving monkeys infected with S h alobium the paired worms travel against the blood stream into the finer b a ches of the me e terre or pelvic veins. The female leaves the male and penetrates as far as p ss ble into the ve ules g e tly distend; g th m. As she with draws she dep s ts the ova one at a time with the spine pointing backwards. The elastic veins c at act down bout the ova and the force of the blood stream tends to force the sp e through the vessel wall. The a cause a local inflammatory reaction and finally ul eration so that many of the mr ach the lumen of the bladder or rectum and then are passed in the urine or faeces. The eggs contain a developed miracidium wh a passed. On eaching wat r the shell quickly rupture probably as a result of b gh osmotic pressure in the egg. The mir cidium escapes and seeks a suitable inter mediate host a species of snail. The eggs die in a few days in indiluted f. eces or un. e. As compared with other flukes schistosomes produce relatively few eggs

contained in a calcareous shell and made up of special mass head mantle and foot. The molluse hosts of trematodes belong to the class Gastro poda which are known as snails and usually have a spirally coiled shell a distinct head and a broad flat foot. The molluses concerned in tranmitting flukes have a foot flattend ventrally and are creeping forms (Platypoda). Gastropods with a fin shaped foot are free swimming forms (Heteropoda)



IO MILLIMETERS,

Fig. 331 — Mollusc hosts of human trematodes 2-3. Segm. 11 a 4-6. Hippenits 7-9 Plano b sbossy. Pote and M chand 10 H I usconio its 11 Relayman sophora Robson 12 Milenio I be time Goodl. (By Country of Paul Dartich.)

The following are the more important flukes of man with some of the genera of mollusc hosts which have been demonstrated or suspected

There is still much difference of opinion and confinuon as to the nonecolature of these smalls Fugling-Greenstra and Planorius (Isppania) Paragonius—Melania (and Pometopius in Michigan) O fid neuropausian Comession—Cytomius—Melania (and Pometopius in Michigan) O fid neuropausian Comession—Cytomius—Melania D lance alum—Zebrima S hatematohium—Balanias (chiefly) Physiopius Lymnaen Planorius Pfafferi S marzian—Planorius (chiefly) Physiopius Ballinius S papanetum—Oncome

lana Katayama (Blanfordia) and Schutosome Plana Lymnaca host of F hepat or us a common small of ponds It has a delicate fingular clourated shell with a pointed spire and a deutral opening

Melania the host of Paragonimus an operculated aquatic snail has a turreted shell with an acute apex

Planois the principal host of S manson also aquatic has a rather thick shell rolled in a flat spiral. The spire of the shell is in one plane. The shells of Segmentina (the host of F buikf) and of Hefpentics have a similar shipe

the portal vem to the liver and in smaller numbers to other organs including the kidneys lungs and brain In such locations particularly the damage is manifestly cumulative and not rarely leads eventually to a fatal portal cirrhosi As suitable treatment with ant m my may kill the adult parasites and destroy the ova at is evident that early diagnos s is of importance to the patient

Three species are of great pathogenic importance in man Schistosoma haematohum which causes vesicular schistosomiasis Schistosoma mansoni which causes intestinal schistosomiasis and Egyptian splenomegaly and Schistosoma japonicum which causes intestinal and hepatic schisto somiasis However at least 3 other species have been reported as rare or notential human parasites

I Genito urinary Schistosomiasis Due to Schistosoma Haematobium

Synonyms -Bilharzia disease bilharziasis endemic haematuria

Definition - A chronic disease due to invasion by the parasite Schisto some haematobium of the pelvic veins particularly the vesiculo prostatic



Fig 111-M th d f fe t n n ch stor m a (Aft rFull b n) Freplnt naddt nFg 334

and the pubic and uterine pleauses. The ova of the parasite which become deposited in the mucous membrane of the bladder and are fre quently passed in the urine give rise to haematuria cystitis urinary calcul and other gento unnary disturbances. When the ova are deposited in the walls of the rectum mucosanguinous discharges may result which also contain ova-

History -The Egyptians have undoubtedly suffered from this disease since very ancient times and the history of it in that country extends over thousands of years Ruffer (1910) in the histological study of certain mummies of the oth dynasty (1250-1000 BC) found in the Lidneys bilbarzia ova situated for the most part among the straight tubules

Infection is usually acquired by wading or halling in infected water into which the cercatine of the Schitteners have been di charged from the infected smile. The cercatine come in contact with the skin and as the water exportacts they entir the skin for protection casting off their tails. Penetration of the skin of imm by the cercatine may give use to can indice printing and crythems called in Japan kabure or in Puetro Rico. prignan. The parasistes (o too to o too mm long) harrow sind a vessel are carried by the Bood stream to the lungs and male, their way to the bure

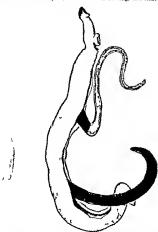


Fig. 332 -- Schinforona japon cam (mai and female). The ship edges of the borders at the big mining of the gyri cophoric canal formed by the male are an accidental appearance. (From Mense).

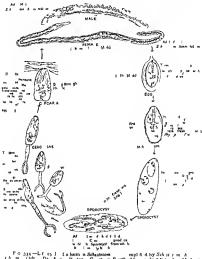
and portal veins. About a month after the para ites enter the body there is often a period of fever associated uith uricarial emphons frequently cough abdominal pain and a leukocytesis with a marked econophila.

The period required for the development of the characteristic local lerions about the variants from 6 to 8 weeks to a years or more. These lessons are dependent on the reaction of the tissues to the critation caused by the eggs of the parasites. They didle in detail with the species of greatsset condetender. They aroube primary the will of the blidder or colour in which most of the eggs may be deposited. Many eggs bowers are washed out of the vent in which they were deponited and carried by

1405

1940) Two cases were also reported from Australia following the return of infected troops from Egypt after the World War However there is no evidence that S haema-lobus materian has ever been endemic in the western beingibles. Several cases we reported in the United States some years ago

Faust bel eves that these were undoubt



the management of the manageme

Prevalence —In some countries schistosomiasis causes more sickness and death than any other single disease Scott (1939) estimates that

in parts of Central and South America

This observation was confirmed by Loose and the writer shortly afterwards had the opportunity to obtain and study such histological mattern! in Egypt. It is interest in this connection that the papyrus Ebers contained a presemption which has been thought to have been for the treatment of one of the most pronunced symptoms of infection with bulkarus namely harmatums. Sandevith in his Affoldo Discuss on Egypt (1936) states that in Aspoleon a campaigns in Egypt (1939-1801) the French troops suffered severely from harmatums.

The parasite responsible for the disease was discovered by Bilham (1853) in the mesenteric veries of a native of Casto and he shortly after demonstrated the parasite to be the cause of haematina in the natives who were discharging the terminal spined eggs produced by the parisite in their urine Cobbold named the parasite in honor of its discovert Bilharsia creating the generic name. However the name Schulatorma had been applied by Weinhand 3 months earlier, in 1858 and thus had scientific priority. Nevertheless the term Bilharsia has been employed for many years in Egypt and, indeed is still the popular term applied to both the parasite and the disease in that country. Masson Balt (1940) till relains it and alludes to the genus Bilhar in (Meckel 1856).

Although Harley who found the parasite in South Africa in 1864 and also Cobbold believed some moliuse served as the intermediate host and that the portal of entry for the infective stage was probably the skin Loss in the student for question from 1884 to 1818 asked to discover the life cycle and concluded that there was no intramoliusate cycle.

The ducovery of lateral spined eggs usually in the faces in contrast to the terminal spined ones encountered in the urne suggested to Alanson sign that there might be a species of human Schulsowies in Egypt, and Sambon (1907) designated the bypo the third species with lateral spined eggs as Schulsowies memors. His e er definite proof of the extrained is a separate species us not given until Leiper 1915-18 from luther studies of the life bastory aboved that there were a distinct species one typically intertained with their alspined eggs and one typically versually with terminal input grat that these apecies were morphologically distinguishable and that they required a distern molliuscan intermediate house.

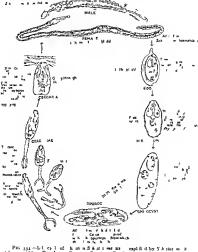
Miyagama Miyasin and Suzuki had previously (1913-14) demonstrated in the aliked infection produced by Schutzowan japoneum the complete life cycle of that parasist describing the intramollocan stage and showing that infection has sequiced by the vutaneous route. This work which was studied by Leiper in Japan provided a bays for his later work on the blood dukes in Egypt.

a basis for his later work on the bislood dunes in Leypu AtcDonough in 1913 advocated the use of textar emetic as a specific in the treat ment of vescular achistosomiasm and the value of this drug on a large scale was demonstrated by Christopherson in the same year.

Geographic Distribution —The disease produced by Schiistowna house to hum has a wide distribution in Africa, including the Sudan Ethiopia Uganda the Congo and Rhodesia. It is common throughout the Union, of South Africa, especially in Natal. It is also found in West Africa especially Liberia and Sierra Leone. In North Africa it is common in Moreoco Algeria Tumes and Egypt. Along the East Coast it extends from Ethiopia to the Cape.

It also occurs in western Asia Arabia paris of Palestine Iran Iraq and in the lower edge of Portugal near Tablera in Greece in the Island of Cyprus and it is also found in the islands of the east coart of Africa Madaguscan Mauritus and Reumon. A few indigenous cases were reported over 10 years ago from western Australia (Manson Dahr

1940) Two cases were also reported from Australia following the return of infected troops from Egypt after the World Wa However there is no evidence that S haema tobus infection has ever been endemic in the western hemisphere. Several cases were reported in the United States some years ago Faust believes that these were undoubt



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edly tamples of spu ous parasit in On the other hand S ma son is very prevalent in parts of Centr 1 and South America

Prevalence -- In some countries schistosomiasis causes more sickne s and death than any other single disease Scott (1939) estimates that at least see million of the twelve million rural inhabitants of Egypt are infested with S haematobium and three rillion with S manson; At least one and a half million are infested with both species together, and about seven million with schieto omiss; of either one or both species

The distribution in Legist varies and for the purposes of study the country has been divided into a regions. In there about 60 per cert of the rural por ultimon was found to be infested with 5 homestellours. In the inst of these is the north and extens parts of the delta about 60 per cent where about 62 per cent when the property of the delta about 63 per sense. While about 52 per cent should either or re- both species. In the second region in the southern part of the delta 5 measures infested not proor than 6 per cent at though the transmitting of the delta 5 measures infested not proor than 6 per cent at though the transmitting of the delta 5 measures infested not proor than 6 per cent at though the transmitting of the delta 5 measures infested not proor than 6 per cent at though the transmitting of the delta 5 measures infested not proor than 6 per cent at though the transmitting of the delta 5 measures infested not proor than 6 per cent at though the transmitting of the delta 5 measures infested than 6 per cent at though the transmitting of the delta 5 measures infested than 6 measures in the first of the first of the first of the delta 5 measures infested than 6 measures in the first of the



Pig 355 -Transver e section of S harmotobium lying a ve sels to ections of papilloma of the bladuer with a few at fed ova a the substrustion ctive tissue

small seemed to be as abundant as in the inst region. No tripographic hydrographic of demographic codifferences between these regions could be nitred, although the following of demographic could be not a could be not a silken in the line of demographic regions in the Valley of the Value and to the south of a for the region to the Valley of the Value and to the south of a for the result has to 6.5 manceus have never been found. In the tind region then Value of the Value

In many other parts of Africa and in tropical America at least in local areas, schistosomiasis must be ranked among the very dangerous human

diseases and in vast areas in China Schistosoma japonicum is also an important human scourge Scott (1940) in the lower valleys of Vene zuela found that the percentage of infection with S mansons was for males about 80 and for females about 60 per cent In the males above to years it reached go per cent

Snails were found infected in different localities from 10 to 75 per cent and he believes that schistosomiasis in Venezuela is as severe as anywhere in the world

Etiology - In Schistosoma haematobium the male is shorter and stouter than the female measuring 10-15 mm in length by 08-10 mm in breadth It has a finely tuberculated cuticle and 4 testes It also has 2 muscular suckers the ventral being larger

Behind the ventral sucker the body of the male is infolded ventrad with the caudal extremity forming a gynecophoric canal in which the female is enclosed during conti lation and oxposition The female is long and slender measuring about 20 X 0 25 mm.
The suckers are small subequal and not conspicuously muscular. The ovary 1 in the posterior half of the body. The on after being fertilized are passed into the uterus which contains 10-to eggs at one time. The eggs measure from 112 to 1700 by 40 to you. They have a yellowish brown transparent shelf and a distinct terminal spine The ergs are deponted chiefly in the veins of the bladder and occasionally a few in this rectum. They are commonly discharged in the unite usually at the end of micturition hut occasionally they are passed from the rectum. On dilution of the urne with 20 or more parts of water viable eggs soon hatch and the m racidia escape as free sw mming organisms which may infect the snail serving as the intermediate host

The following a ails ha e been reported to serve as effective intermediate hosts Bulinus iru cal s (Egypt Cyrena ca and Tunis) B forskal (Mauritius and possibly Kenya Colony) B tropicus (South Africa) Physopsi af cano (South Africa and the Belgian Congo P glob sa (Sierra Leone West African Coast northern Nigeria Ny saland and Rhodenia) P nosita (Kenya Colmy) Planorbi d f u i (Portugal and Morocco)

On leaving the snail the cercanae swim about in the nater at times sinking to the bottom and then again swimming back to the surface where they may become attached for a period by their ventral suckers. When human beings bathe or wade in such water, the cercariae come in contact with the skin and as the water evaporates they enter the skin for protection casting off their tails

The peri d of their free I ving ex stence is short being limited at most to 3 days usually to 4 hours or less Latry through the outer portion of the ep dermis lakes place in less than half an hour and usually within 20 to 24 hours the larvae or meta cercariae have gained access to the peripheral venut's

PATHOLOGY

The earliest manifestations of the disease are associated with the entry of the larvae into the skin which may result in intense pruntis depending on the intensity of the exposure and the sensitiveness of the individual Some minute petechiae may be seen at the sites of the invasion of the cercatize into the blood vessels. Some days later there may be an urticanal rash. Sometimes still later in severe infections toric symptoms consisting of anorexia headache generalized pain in the at least six million of the twelve million rural inhabitants of Egypt are infested with S. heamatohium and three million with S. manson. At least one and a half million are infested with both species together and about seven million with schistosomiass of either one or both species

The distribution in Egypt saires and for the purposes of study the country has been duried into 4 regions. In three about 60 per cent of the rural population was found in be indested with 3 hermathium. In the first of these in the north and eastern part of the delta about 60 per cent were also infected with 5 monars, while about 85 per cent aboved either one or both species. In the second region in the southern part of the delta 30 monars infected out more than 6 per cent atthough the transmitting



Fig. 335 — Transverse sections of S haematobium 13 ing in vessel ns ctions of pap floma of the bladder with a fee calc fied ovainth subseries connective tissue

small seemed to be as abundant as in the first reg on. No topographic hydrographic of demographic differences between these reprose could be notified although the line of demarkation was very shrip as far as prevalence of the parasite was observed. In the third and fourth regions in the Valley of the Nile and to the south of Garon the small hosts of S. monitors have mere been found. In the third region then S. with the state of the parasite was observed. In the third region then S. with the state of the parasite was the state of the parasite was the parasite the

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istion of the certer and of the pelvas of the lodney frequently results from prevention of the centiflow of the sume or ther due to leasons of the bladder or to the treets them selves. Lessons of the certebra may lead to fibroad thack-enongs and distula in the male in women the vagume vulve and cervar are particularly unclosed. Large areas of the adjacent skin may become relified with discharged same as the track of which is lined with granulation tissue in which the o a are found

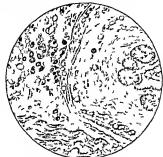


Fig 336—Set nof wait of bladd h wing over of Sht m h met b m t me which h und gone calc fic ton

Symptoms

The symptoms of infection with Schristosoma haematobium are very variable. In many cases the infection is practically aymptomiess, but in other instances the suffering is very great and the infection ultimately results in death. Early torce symptoms such as fever and urticaria may come on within a month after exposure to infection. On the other hand the incubation period from the time of infection to development of symptoms of disfinite organic disease may vary from 3 months to more than 2 years.

The most straining symptom indicating deposition of the oxa in the mucous membranes of the bladder is passage of blood at the end of mictuition. Cenerally, it is only the last few drops of unne that contain blood but in severe cases the haemoritage is more extensive and the unne may be blood tinged throughout. Occasional clots are present in such unne one almo t im anably finds large numbers of terminal spined eggs. Sometimes when they are not discovered in a large sample of

back and extremities and a rise of temperature accompanied by a rigor and night sweats occur. The blood often shows a leucocytosis and ocsinophila is sometimes as high as 50 per cent. In some instances the abdomen becomes swollen and tender, the liver and spleen enlarged and there may be precordial pain. Usually there is no distribute or distributed with the second process of the oval have invaded the rectum.

Several months may intervene between the deposition of the eggs in the tissues and their first appearance in the unne. Eventually there is apt to be an increasingly frequent buring at the time of unnation and an increased desire to unnate. Cystoscopic examination may revail hyperplasia and inflammation of the mucous membranes of the urban and lower segment of the bladder. Paptilomatous growths may also be observed in the lumen of the bladder. Such pathological changes are particularly due to the deposit of the ova in the tissues.

Their presence gives rise to a round cell infiltration, the proliferation of the epithelial cells and the production of what has been called bilharzial granulation tissue which at first assumes a hypertrophic and later an atrophic form In the hypertrophic form which is more common in the mucous membranes, there is marked proliferation of the epithelium which leads directly to the formation of papillomatous growths or to the forma tion of vesicles containing turbid fluid. By bursting these may give rise to ulcerations. In the atrophic form the granulomatous tusue becomes more fibrous as the process becomes less acute and in these areas very few ova may remain. In sections the ova may be seen escaping between the epithelial cells of the mucous membrane The fine capillaries and veins beneath the epithelial linear and the loose connective tissue in which they occur are also often filled with ova while in the deeper sub cutaneous tissues coupled pairs of the worms are often found in the vessels The amount of round cell infiltration and of fibrous tissue present varies according to the age of the process

One of the earliest manifestations of achistosomiasis in the mucous membranes is a characteristic velvety swelling. The surface is usually dark red and has the appearance of a thick telvet. In other instances in the mucous membrane of the bladder there may be a fine brownish yellow powdery appearance with here and there the development of sandy patches in the wall. In the small pupillomatous outgrowths, the central core is vascular and composed of loose connective tissue being practically continuous with the submucous tissue The core of the papillomata is infiltrated with leucocytes lymphocytes and eosinophiles Later giant cells make their appearance. The ova are scattered irregularly throughout. As the ova approach the surface of the mucous mem. brane in large numbers the surface epithelium undergoes necrosis the papillomata become granular and shiny and bleed easily These also frequently ulcerate particu larly when they occur in the intestine The ulcerations may al o occur in the intestine independently of the formation of papillomata and deeply punched out like ulcers may result and give use to symptoms of dysentery At a later stage in the bladder the whole mucous membrane may be so altered in color and atructure that a regular calcified lining is formed which gives at autopsy a characteristic gnilly feeling to the hand The walls of the affected organ in these instances are generally large and thickened partly from muscular hypertrophy and partly from the deposit of phrous tissue. In the bladder the eggs not only give rise to haematuria but constitute the nucleus for cikuli Cystitis results usually and frequently extend to the ureters of the kidneys Dila

SYMPTOMS 1400

tains of the arcter and of the p lws of the badney frequently results from prevention of the couttion of the unre c their does to be one of the badder or in the urrest them extres. Learner of the meth a sawy lead to fisher of the cleaning and fit tols in the male in women the vague, valves and exercise are particularly involved. Large arcsis of the adjacent claim may become raddled with descharged sunsess the track of s luch is lined with granulation tissue in which the o a are found.



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SYMPTOMS

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SWIPTONS 1417

Thus the over may be corned into the inferior mesentery years and give nse to Schistosoma appendicatis Campbell in northern Nigeria found ova in 57 per cent of the appendices removed by operation He considers that the infection may produce symptoms requiring urgent surgical



F1G 332 -- V h w g fistulous tracts op n



Fig 338 -P typ dt m m s t lisch to m tAft Ni dd)

intervention Sargent (1937) and Kaufmann (1937) have also called attention to Schistosoma appendicits. Usually however the presence of the ova in the appendix does not result in acute inflamatory attacks

Small numbers of ova are also frequently swept back through the portal vessels into the liver where pseudotubercle formations and some times abscesses result followed by polypoid fibrosis of the periportal tissues Makar has reported primary disease of the gall bladder giving

urine one can find them in the last few drops passed especially in the urine which is forced out by straining. Pain is not always present but in other instances there may be pain in the suprapulse region or in the perineum. Frequency of micturition is often an early common symptom and there may be a scalding sensation of the urethra during and after passage.

The endemuc haematuria may last for months or years and when the infection is severe cystitis soon supervenes and may give rise to consider able suffering. In chronic cases the eggs not infrequently become the nucleus for the formation of calcula and large stones are not uncommon especially in Egypt. Multiple small stones are also encountered.

Papillomata which develop in the nalls of the bladder not infrequently become main annt. Brumpt 1936 has made a careful study of the role that Schistosoma plays in the production of human carcinoma.

A statuted study made in Caro showed that the association of schistoniums and of carcinoms of the bladder is from 2 to 11 times more frequent than pure cancer of the bladder. Sorour in a study of 413 cases of schistonomiass of the bladder of thich 393 were in men and to in some found that among the 333 can there were 78 cases of carcinomia of the bladder 3 of bisharzail carcinomia of the bladder 3 of bisharzail carcinomia of the section 1 of bisharzail carcinomia of the skin in the angunal ergon. His statistics further show that bisharzail carcinomia of the bladder appears in the first period of he 13-10 years of age and that it becomes augmented in frequency as age progresses

Besides symptoms of the bladder there may be evidences of prostatue disease or of vesculae semmales involvement. In the latter case ova may be detected in the semen. In other instances as mixtoms elevelop in connection with leasons of the urcters and kidneys. Dilatation of the urcters and hydronephrous may take place and attacks of renal colic may occur in such instances secondary septic infection of the urinary tract is frequently a complication. Many of the patients become anaemic wasted and debutated. Urinary fistulae are not uncommon in connection with disease of the uricthra. They are especially common in the perincum and posterior surface of the scrotum.

Stricture of the urethra is by no means uncommon.

Pseudo elephantiass of the sheath of the pears may also occur in which ou a five found deep in the tissues. Infection of the spermatic cord is not infequent. In women vagaints and cerviritis may occur and papillary growths and uters which may in some instances become mahapant. Papillomatous rasses containing ava are also sometimes found on the vulva and may simulate venereal warts. Surjout found in so women infected with schindronniass there were a cases of cartinomia of the bladder

Rectal symptoms with passage of blood and mucus may coewis with unarrys imptoms. These lessons may be due to invasion of the intestinal wall with S hamadohum or to mived infections with S monion. Both Shalid and Scott have pointed out that a high percentage of the people morats of Egypt are infected with either one or both species.

Rarer Lesions -It seems not improbable that almost any organ of the body may sometimes be invaded by Schistosoma hematobium

PROGNOSIS

In the milder degrees of infection which are the commonest the patient is usually not inconvenenced by the parisite thought in almost all cases there may be attacks of haematuria from time to time. In severe chronic infections however much suffering usually results and as a consequence anaemia and debutly follow. The intensity of the infection is important in connection with the prognosis. In severe cases chronic cystitis is very common and calculus may result or grave renal disease follows. The papillomatous or epitheliomatous outgrowths in the bladder may become malignant. In recent years the discovery of the value of antimony in the treatment has greatly improved the prognosis in the majority of cases in which it is instituted early.

PROPHYLAXIS

Especially in urine and facees of infected individuals which contain the ova lies the source of the polution of water in which the snalls which constitute the intermediate host become infected. Hence it is most important that there should be disinfection or other sanitary disposal of excreta and every attempt made to prevent the evacuation of infected excreta into the surrounding water supply

In the endemic districts man frequently acquires schistosomiasis from bathing wading and washing in streams and pools where Schistosome cercanae are present. Infection may also result from drinking such infected water.

Therefore prophylactic measures also should be directed toward education of the population to refrain from drinking from or bathing in the rivers ponds and canals and sportsmen should be warned against wading in localities known to be infected. In such localities drinking water should also be boiled. The cercariae can usually live free only 42 to 48 hours in water. Hence impounding infected water makes it safe for bathing and drinking, as does also its superchlorination for more immediate use.

Other important means of prevention are chemotherapeusis of infected individuals and antimolluscan campaigns

As regards stenization of dunking water boiling is by far the most satisfactory method. Chlorium in the strength of 1 7 000 000 which has generally been employed to stenize dunking water appears to be meffec the upon the hiving cercanae. However, Witenberg and Yofe (1938) have reported that gaseous chlorine is really the only agent which can be employed practically and that can be depended upon to kill the cercanae.

Chio ne water containing a grams per later is prepa ed by introducing gascous chi med directly into the water. Two grams of a numnous and hind cR(II,CI) are then die olved in 100 cc of this chlorine water. The solution is then left to sland for hours at rouns inequestative? Of this robust as 2 cc are dissolved in 11 let of water. This continues the continues of the continues of the continues are continued to the continues of the continues of the continues. They is und chlorine to to the most effective form of allows the continues. They is und chlorine to to the most effective form of allows the continues are lateful effect was certal an item stan possible story as per million of a specific many continues.

rise to duodenal stasis. The interior of the bladder was studded with sandy patches such as are more frequently seen in the urinary bladder

The ova and even the parasites may be carried through the hypo gastric and common iliac veins and inferior vena cava and the right heart and then become located in the lungs. Turner has pointed out that large numbers of the ova in the lungs may give rise to a form of intersitual pneumoma. Suarca (1931) has reported an infection of the lungs may give rise to symptoms simulating bronchial asthma. Shaw and Ghareet (1938) have found pulmonary lesions due to the ova of Schitstoomes in 33 per cent of 282 autopsies upon Egyptians. S. haemalobium was almost twice as common as S. maisson.

Adult worms were found in so per cost of the pulmonary cases. Owe reached the loops as embold and caused an acute necrotosing attendities. The owns escaped through the vessel wall and became the center of a parenchymatous tuberde. In some instances they found an increased instandinancy blood pressure with diffus attental changes and hypertrophical right ventrale producing a condition resembling Ayeras a disease.

Ova have also been found in the brain and spinal cord in patients who have suffered with epileptic and paralytic symptoms

Day and Kenanay and Bayouns (1939) each have reported cases of bilbarral mediats the overbring demonstrated at autopsy on the lumbar ralargements of the transfer unterstand the state of t

In rare instances the adult worms themselves in copula have some times been found in the urine in connection with a copious hemorrhage with rubtured vessels.

Diagnosis - Diagnosis depends upon finding the oya with a terminal spine in the urine More rarely they may be found in the faeces Fig 339

A complement fixation test has been deruxed by Fariley (1977), with an alcobable extract of the livers of south infectival with S-measures a santigue. He obtained positive reactions in a large proportion of cases of early infection with both S-marious and S-homestoleans and believes it can be used to check the results of treatmost. The method promises to be of practical value if a standardized antiger can be made available for the standardized antiger can be made available.

Fairley obtained positive culoneous reactions (also group reactions) by using filtered saline extracts of infected livers These reactions persisted after apparent cure

The presence of haematuna in areas where the disease is endemic is a suggestive symptom in diagnosis. Cystoscopic examination and some times digital examination will often give suggestive information. The disease should be distinguished climically, especially from renal calculus due to other causes and from hemipa and malignant growths of the bladder and rectum and from haemoglohimuma and bacterial cystitis.

cated as necessary by Horrock a water testing method plus 2 a contact period of half an hour being advised

Brackett has reported that the cercanae are very susceptible to form aldehyde and that a o or percent solution will kill them in a minute or less

For the destruction of sna is ammonum sulphate in weak solutions has been recommended since Lills the snails in a few hours Copper sulphate in high dilutions 1 100 000 and sometimes even 1 100 000 will also kill the snails Care should be exercised that the copper is not introduced in a strength that will kill the first.

Brackett (grap) points out that in this connection copper carbonate which is less in tube can selfely be applied in excess. He recommends s/10 one of a point for each calculated cuber foot of water. However the organic market in the water may fix the copper and render it insert. In some localities, the suppumps of this settem into the water has been the most satisfactory measure to till the smally. The smalls may withstand dyrum for considerable provide and some which burneys in the small way survive.

A mollus once infected may continue so for months but fortunately the free cercarfes the but a very hort time at most some 45 hours in water. Free cercarate how ever re dily pass through the ordinary municipal filter beds and they can traverse joinchest of fice and in a fower. In Egypt in received, years the destruction of the scalab in some localities has been attempted by adding a preparation called. Sucolo. I so soot to the water. However very great difficulty has a steaded the statempts in Egypt to erad cate the same is in endemic regions. Thus Khalil reported that in one region the Bulium studia were completely estremanted to an solicited regarder egion by municip copper sulphate is 200 000 to the entering water but a few months later the Bulipuis smalls were present in Erge numbers and sa appears that parts of the hell testif contain

Sort and Batolow (1935)) is reporting upon the sanitary campaign carried out during a six year prior in Ergyst state that white a reduction in the amount of infiction of lowed the admi start on of an much treatment is the people to lid be permaded to take and that suck similary measures as acre powels one of the translated states we sens the risk of Schuston mainfection had returned approximately to its organical level. Thus the chemother-queling or gram had variety of the state recreasing and the infection itself appeared to confe little if a y immunity to subsequent infection.

to succeptent interior. Some we emphasize that the fact that as its its of did not cause or even maintain a lower le el of praviste indiction should not maintain guarant its value and that it has not course reflected much sudden; They emphasize that complete claumature of unne and faces from the canals would put scholscomusas under control interior levels and on the safe; and the entire difficulty interior promise no sade point on most the water and the entire difficulty.

Canston (1944) thinks that pr phyl xis is particula ly a problem f r the engine r forced disturbante of water containing the fragil cerea tae bing more serviceable that the containing the fragil cerea tae bing more serviceable that the containing the fragil cerea tae bing more serviceable that

chem cals

the man chem cals are the construction of the dease in such coult could c

secured

TREATMENT

The intravenous injection of tartar emetic as employed for treatment of Schistosomiasis by McDonagh and Christopherson has proved of great value in the treatment of all forms of schistosomiasis. The drug

available chlorine remains after to moutes. Lower concentrations are not certain even if longer periods are allowed. If sodium hypochlorite is used a sure effect my be expected during a hour and 5 minutes if there remains o a8 per milhon of available chlorine remains before and during 30 minutes if 0.42 per milhon of more of available chlorine remains



Fig. 339 -Ovum of Schistoroma haemotobium (After W II am Pepp e from Jefferys and Maxwell)



Fig 340—Ovum of Schin s me m numi (After Wil am Pepper from Jefferys and Nagweil)

4[ter 10 minutes If gaseous chlorine is used a sure lethal effect will be obtained

it the amount of the available chloring after 10 minutes is 0.15 per milion.

Sproale (1939) has also found after extensive experiments that chlorination will destroy experime provided that the amount of chlorinum e-mployed equals that as inchestroy experiment provided that the amount of chlorinum e-mployed equals that as inchestroy experime provided that the smooth of the minute of the minu

cated as necessary by Horrock's water testing method plus $_2$ a contact period of half an hour being advised

Brackett has reported that the cercariae are very susceptible to form aldebyde and that 0 03 pe cent solution will kill them in 1 minute or less For the destruction of Sad is ...mmonium sulphate in weak solutions

has been recommended since Lills the snails in a few hours. Copper sulphate in high dilutions 1 100000 and sometimes even 1 1000000 will also kill the snails. Care should be exercised that the copper is not introduced in a strength that will kill the fish

Brackett (1939) points out that in the connects in copper or bonate which is less soluble on safely be applied in excess. He recomme day of cook of a point of reach calculated cuber I out of water. However, the or gan c mitter in the water may fet the copper and render it inset. I move peck lead the step mapping of his estimation to the water has been the most satisfactory measure to bill the smalls. The scalls may withstand dryms for considerable periods and some which burnes in the may survive

The production of the price and so do more as the Courses with a minute system to the free error and the production of the case and in plows. In Egypt in recent years the destruction of the canalis in some localities has been attempted by adding a preparation called Sizolin 7 some oot to the water. Howe er very great difficulty has attemed the strength in Egypt to cradit at the sands in order of regions. Thus Abalit reported that in one region the Bull 18 main where completely extern nated in an isoulted urgated region by maximum copper sulphate one one in the entenin, were that a few months it or the Bullium sanish were present in in ger numbers and is appears that period the ball studied that the continue of the production of the producti

Scott and Barlo (938) in reporting upon the sant ry campaigns carried out during a mr year period in Lepys state that while a reduction in the amount of infection fol formed the adm station of as much treatment as the people could be persuaded to take and that such san tary measures as were possible were carried out invertheless after two years the rate of 5th stooms infection fold returned approximately to fix original level. Thus the chemotherapeut e program wa unsuccessful especially due to constant receptious and the infection intell appeared to confer hite if any immunity.

to subsequent infection

secured

Scott and Baylow however cm has e that the fact that anniation of d not cause reven munta a lower le 10 perastic infection abould not militate against its value and that it has of course releved much asidering. They emphas ac that complete eliminat on of une and facer from the canals would put schistos mu is under control much asiders the second of the control of

is based on customs which lead to di ect polution of the calls

Control of the small hosts could also reduce the level of infection. However the simple d ying if the can is was not found to be effective a some of the smalls burrow it to the mud. Nor did the nee of chema c lag nts appear to be partie. I keep if the canals free from vegetati n appeared to be a satisfactory means of reducing the number of smalls.

Causton (1944) thinks that p ophylars is p rt cularly a problem for the ing n to ced disturbance if water contain g the fragile cercar as being more serviceable than

chem cals

Apparently the only permanent advance in the control of the disease in such coun
tries as Egypt and Venezuela will result when proper disposal of human excreta is

TREATMENT

The intravenous injection of tartar emetic as employed for treatment of Schistosomasis by McDonagh and Christopherson has proved of great value in the treatment of all forms of schistosomasis. The drug

apparently acts upon the adult trematode by cumulative action. Under normal conditions when the freshly passed unitary deposits is mucel with warm water at 136°P the hatching of the eggs usually takes place in about 5 minutes but after the patient has received injections of antimon tartrate it is found that such eggs as appear in the inne are dark and shrivelled and contain dead miracida. Christopherson beheves the change to be due to the direct action of antimon upon the eggs. Fairly from experimental studies on the allied species S spindalis of the goal beheves that antimony, acts first in a selective manner upon the reproductive organs of the female bulbarran and thus causes first a shrunken appear ance of the egg and second a cessation of egg laying capacity. finally a destruction of the adult prassites occurs.

Tatta Emete: (Sodium Anhmony Tattati)—It is recommended that the intrevious injections be given on internate days over a period of 4-6 weeks. It is usual to begin with Mg grain (e.o.g Cm.) does for children and Mg grain (e.o.g Cm.) for adult dissolved in a commisse of distilled water and then obtated with an equal amount of normal saline. The does is increased by Mg grain until Mg grains (e.o.g Cm.) is reached unless a reaction in produced before that time. Inspections are then given every old day the dosage being Mgo) between 2 and 3-5 grains (e.o. 10 o.o. 10 m) until 25 or gains (f. 10 a.) 3 (fm.) is given. This amounts is supply undication to come and 25 to gains (f. 10 a.) 3 (fm.) is given. This amounts is supply undication to come and be basis of 0-00 Cm. per Mio O body weight. Treatment must be proceeded with cauturally as some patients they a prenounced infolgrance of the proceeded with cauturally as some patients they a prenounced infolgrance of the most contraction.

It is advanded that the patient should remain in a recumbent position for at least one hour after each intravenous administration. The drug has a depressing effect on the heart circulation and respiration. The blood pressure falls while the pulmonary

pressure rises

The antimony is slowly excreted and has a cumulative action. After tone dose
fixty degeneration of the hier kindepy and beart may be present with competion
of the dura matter and cerebral wessels. According to khalil the principal organ of extre
tion is the kindey. In patients with cardiac pollmonary and hepatic disorders the
drug in usually contrasindicated. While sudden death has sometimes occurred the
deaths from its administration are said according to some tatastics to constitute
about to 1 per cent. Mahaner and krause (1939) have more described pathological after
excess were found and changes of the ST interval as well as in the T deletion of
about the product of the ST interval as well as in the T deletion of
antimony though the process in most cases was not chinically evident.

Usually following treatment with antimony a rapid improvement in the condition of the urine is observed all traces of blood disappearing. In Egypt Khalil has recommended a 6 per cent solution for use. The course consists of 12 injections given 3 times weekly until 22½ grains of the drog lawer been administered. He occupies a necks: Faithy she confirmed the specific action of tartar emetic especially in its effects in S spinidair infection of goats and has shown that it is capable of killing off the adult biliarran parasites and eradicating the disease.

The pentavalent compounds of antimony as neostibosan and neostan do not seem to be as efficacious as tartar emetic

Foundin (Neoanimosan) (Bayer) —This is a trivalent compound animosy pyro catechin dissiphonate of sodium (containing 13 per cent of animony) which was introduced in 1020 espect By for the treatment of bilbars as in Egypt. The drug is administered intransicularly on alternate days and is a dit to produce no local riritation of sloughing at the site of the injection. It usually causes no natises or counting coughing or 1207s. According to Kahali the whole course of the drug consists of the intransicular inject on of the 7 per cert solution as follows.

rst day	1 5 cc
and day	3 5 cc
Then on alternate days	
3rd day through 17th day	5 o cc each

It is claimed that a cure may be effected in 19 days. Fifty per cent of the drug is excreted in the urne and 4 per cent in the facecs. Khalil (1930) treated 1479 cases with foundin and states that the cure was obtained in 97 6 per cent.

foundin and states that the cure was obtained in 976 per cent

D amantis (1938) emphasizes that there are many deaths which occur annually is
Exprit from the use of foundin and points out the necessity of giving a mu ed antimony

and emetin treatment in quantities which are below the lethal dose of each.

Other authors belie e that t eatment with tartar emetic is more effective. Other
drugs that have been part cularly recommended for treatmant are emetin and antihio

mains
Ty kalas believes that when emetin is given intravenously (in doses of 1 to 15 gr)
that it is superived every other specific. Howe or toucksymptoms distributed would
reg and neutrials are apit to ensaw when the drug is given intravenously. Typialias how
ever has also reported good results from injections of the drug intramuscularly in doses
of 13 gr of 10 the total course busting to 6 as in 5 in wells.

Anthomaline a l thium salt of ant mony has been recommended particularly by

Moulin rd and by Canston but it has not yet been widely employed.

Ashkar (rgs) has reported on the treatment of a patients with unnary schistosomas with the drug is 6 per cent solution. The drug was found to be more toru:

than foundin and to gave rus to unpleasant symptoms as some of the cases but the

results of the treatment of the majority after from 6 to 9 spections were favorable. In

one patient the valver if it have passed after the funds to results or

Local Treatment—For the treatment of the urmary calcult and new growths in the bladder surgical intervention is sometimes necessary When cystitis and distress are extreme pernned according and drainage may give relief Pernneal fistula and stone and stricture may also require relief by surgical operation

II Schistosomiasis (Bilharziasis) Produced by Schistosoma Mansoni

Definition—A chronic disease produced by Schistosoma mansons characterized by intestinal lesions frequently resulting in dysenteric symptoms and by visceral complications which may give rise to spleno merals and to circhoss of the liver

HISTORY AND GEOGRAPHICAL DISTRIBUTION

Hastoy—In 1851: Il Bura observed hiteral spread egg an some female Schatzoomer. In und at antopys of an indvisald by g mc C no Section and Marson who also observed lateral spined eggs in female worms suggested that a d stinct species was concerned. However, the spread to be a hypoth so and it was suggest of that the peech r position of the spine of the univas due to duto to not the egg shell either in the dute or in parsing the ough the mescular coat of the rectum. In 1903 who had not not the spined of the spine of the

of the egg shell from that of S doemetobion but also an account of the clinical picture produced by the parasite and different geographical distribution created the species S monatons for this parasite. Later he reported upon many cases of lateral spined schoosomuss from South America.

Holcomb and Da Silva (1909) first described the peculiar assumed districtions of S mattern. The autopay studies of Fla (1917) and Risquez (1918) further sob stantisted the idea of a different species. Lesper (1916-18) finally proved upon metally the distinctions between S mantom and S harmafolium demonstrating this married has atthesh from Internal spaced eggs developed in Egyptian analis of the Planories and not of the genes Bulinus and also that there are constant morphological distinctions between S mantom and S harmafolium.

Geographical Distribution —It has been suggested that S mousens was originally a West African species

Its geographical distribution includes the Nde Aulley and the upper Sudan and along the Fast African Coast from Annahor to the Zambers upore: extending inhald to northern Rhodess. Tanganyaks and the Relgan Congo. A few cases have also keen reported in Natal and on the Transeval and Madagasser. In West Africa to suite button extends through Sengual and French Guines to Lake Chief. It has also keen found in Lake and herein Leone. Van dem Berghe (1939) has found to come throughout the Belgan Congo and generally distributed at all altitudes below 1900 meters. The only casts transeval in Asia age the few in Archas a keep terms.

In the western hermsphere it has been suggested that the infection was probably introduced originally by African slaves. It occurs expectally in northern Brazil and Davis (1934) who made a study there of specimens of the here obtained with the viscerotone found exidences of infection in 1934 sections. Martins and Dos Anjor (1933) believe that the infection has been recently introduced in Northeastern Brazil where they found in the Province of Minas Gerese an incidence of iron 3 to 85 per cent in different localities. It has also been reported in earlier years in least read and more recently in that country by Mendoza (1936). Scott (1930) found in mountain valleys near Caractis at least 70 per cent of the rural population to be indected inciding pratically every made over 10 years of age. He believes that schistosomoasis in Venezuela 15 as severe as anywhere to the world.

It is also common in Dutch Guara. Variet and Hoffmann found it in numerous localities in Purtos River and it has been suggested that it occurs in Santa Domings Cameron in 1932 found a quarter of the population of St. Latte to b infected where he also found the sufection common in the their African green countery Cerephoreus sobsens. The infection is also common of ewhere in the Antifics motably at Antique Guadeloupe Hartingue St. Luran News Momerant and Vegot and

ETIOLOGY

Morphology and Life History—Schulscome measures (Sambon 1907) in its adults abuse resimbles S harmotohuses but it is generally undier in its and more troubly tuberculated in S measures the Genale annually deposits only one egg at a time but probably produces from one to set real numbered eggs per tay. The eggs are nomen than those of S became there: The adult made paras is measures from 4 a toy 9 mm flow and the learned 2 x 10 x 4 mm long. The testes of the made mumber 6 to 7 in the female the overy 10 mm for the control of the theory of the testes of the made mumber 6 to 7 in the female the overy 10 m flow and the learned 1 mt of the body and the uterrus is comparatively thought it is probably for this restouch that in only deposits one owner at 1 mm. The

gut branches reunite in the anterior half of the body. The eggs which are usually passed in the facces rarely in the unine measure rra to rycu in len th by 45 to 68µ in hreadth They has a yellowish brown transparent shell and a characteristic lateral some. The sexually mature worms are found in the human body particularly in the mesentenc venules which drain the large intestine and the posterior segment of the deum sometimes in the upper branches of the superior mesentene vein the vesicular plexus and within the intrahepatic portion of the portal years. The sexes are often found senarately in contrast to what is usual with S haematobium. However at the t me of oviposition the females are held by the males in the gynecophoric canal in the small venules adjacent to the intestinal wall. The ova are deposited directly in the venules of the colon and especially of the ectum frequently in the submucous layer of the intestine Rarely they may be deposited in the venules of the bladder. The ave soon break out of the vessels and are discharged into the lumen of the intestine In other instances lying in the submucesa they give ti e to inflammatory processes resulting in the formation of pseudotubercles or of small absces es. The ova are al o carried in the portal stream into the liver and here in the periportal tissues also occasion inflammatory reactions. A large number of them passing through the intestinal wall are duch reed with the f eces contain m blood and mucus. She tly after their pas sage the eggs which are usually mature batch throu h a rift in the shell and the miracidia which are larger than those of S haematobium escape. In water the free swimming period does not usually exceed 16 hours and to survive the mirac dum must p as in this time into the molluscan int rmediate host

The life cycle within the son I sparable to the 16 S homeobox with the son I sparable to the 16 S homeobox with the conditions a numium period of a week as sequence When the creating scenarios the sail they resemble those of S homeoboxisms. They attack and invade the akin of the human be it and mg as through the blood stream to the attrabupatic portain stream in a similar way to S hee color. I lone r Fauri and Hollman have found in the in e-permental infections of animals the met cercarias of S or strong a not immediately filtered out on the rarrival in the liver and usually pass through the hepstic cardillares in the langs and general cuits. I from one to several intense bit refinally accumulated in the lumps and general cuits. I from one to several intense bit refinally accumulated in the human host is about 7 weeks.

The mutu e worms sometimes first outpo. I in the slow-colle and colle branches of the superior meetater or in and the colle branch of the inferior meetation later wanders downward into othe a automotes of the venous ciclation. Day (537) has found that the dulft worms may ravely my rate by the accessory portal circulation and be carried to the pulmonary arterioles. Lesions of the fluence are common compliations of the stdern.

Intermediate Hosts—The intermediate mollucian ho is which are known include Planob bostitys (Egypt and Holman East Africa). P electroderms and P horbot (Sodian) P glef of Availa Southe a Rhodena Settra Loone) P indiancias (Nyaza Loud) P descenti (Belgian Comps) Autola b gled dent (Grone by Planobly goods and Posterio (Belgian Comps) Autola b gled dent (Grone by Planobly goods of Advisory of the
The species of Pla bis which occur in No th Amirica. Eur pe and the O entible go different goups from those in Africa and trops al America and may not be cipable of serving as intermediate histoflumnan infection.

EPIDEMIOLOGY

S mansom apparently requires somewhat different conditions for its propagation than S haematobium. Thus although the two infections are frequently found associated in Africa jet the distribution is not identical but depends particularly upon the distribution of their respective intermediate small hosts. Also there are areas in the southern Sudan and in West Africa where S mannon is not uncommon jet S hoematobium is not found at all. While schistosomiasis occurs in is of the 14 provinces of the Sudan. S hoematobium is the common type in the north while south of the upper Nile provinces intestinal biharmasis due to S mannon is the only endemic type.

Although monkey's have been found infected in nature and may bare been an epidemiological factor in the spread of the disease in St. Aits human infection is usually acquired from other human cases of the disease. The infection is commonly disseminated by the deposition of the infected facees or dramage from them into the water courses which contain the appropriate intermediate molluse hosts. Sewage from towns in endemic localities that is discharged into streams may also be a source of infection

In the mountain valleys in Venezuela when the infection rate is high (at least 70 per cent) Scott (1940) found infection is frequently acquired because of the pollution of canals near dwellings but random pollution in the fields was also of could importance

The disease is acquired by direct contact with nater contaming the cercariae the parasite passing through the buccal mucosa by draking such water or directly through the skin in wading or bathing. Entrance of the cercariae may be effected through the mucous membranes not only those of the mouth but of the gentalian and anus and even of the nasal mucosa. Experimental infection by mouth has been obtained hat because gastice juice may destroy cercariae when brought into contact with it it seems probable that where cases have occurred from draking water the cercariae probably immediately traversed the buccal mucous membrane and entered the veins or I mubative vessels in this way.

In Egypt the infection as acquired especially during the months when the write it sufficiently shallow to permit of a high concentration of certains. In the Alder egyon, the most diagnosis period is usually from February to June but in the case of some of the inhand lakes the small incidence of the disease is from October to the end of January Infection of the water can frequently not be determined by its appearance. Thus in Northern Nigeria and in Menny cases of infection have been reported following, bathing in clear timpolt pools containing no supported aqualite vegetation.

Neither sand filtration nor nfurminum sulphate clarification will remove the cercariae although they may be destroyed by chloramine sodium hypochlorite and gaseous chlorine. Wittenburg and Yofe state that gaseous chlorine is the only practical method and recommend for this purpose a chloramine solution which contains from 1 to 2 parts per million of active chloramine (see p 143).

PATHOLOGY

The pathological changes are produced in the intestine by the ova Owing to their sharp spines and chitmous shells they act as irritating foreign bodies in the intestinal wall and cause probleration of the cpi thelial cells of the mucoca and an inflammatory reaction consisting of the formation of pseudo tubercles in the perturbacilar tissues and later on small above sets. By probleration of the epithelium the mucous membrane becomes thickened and papillomata are often formed which may be very vascular. By rupture of the blood vessels necross of the epithelium and the formation of septic foci in the museularis and submucosa ulterations occur in the bowel wall sometimes produced by the tearing off of the papillomata through the pristaltic action of the intestine Eventually well marked ulters may be produced. In some instances per foration of the bowel may re ult. When ulcerations of the papillomata occur in the intestine symptoms of dysentery (r. 450).

Fairly from experimental studies in monkeys has found the eatiest lessons occur as pose jubineries a mail white modules consisting of herbidistic cells with farge nur hern of co mophiles. Lampe has also observed presidenties is in the meanetine glands in hims nears of infection. They may be castered through all organs and particularly on the personal coat of the lowel. They may also occur in the nuccous men bantes and may be seen with the aigmndo cope.

In the liver the ova may be found in great numbers. In some instances in which the disease has been long chronic a form of pipe stem eurhous may result. Massive congestion may occur. In the advanced stage due to thickening of the large veins of the liver a pen ortal fibrous eurhous results and ascites is not uncommon unlet compensatory distations of the collecteral veinous circulation occurs.

The spleen may also become greatly enlarged due in some instances to influration with ova but also in ome cases more particularly through passive congestion for in many cases ova base not been found in the spleen. Ons however believes the ova frequently are destroyed in the spleen and it is for this reason they are not more often detected there.

The own may also at times escape into the tissues of the lungs pantness kidneys adsectable myseathour and even the aspiral cold and can give it is to inflammation; changes in the organs. Ying (1941) et al have rejected the presence of wa found at succepy in the brains and messine here and log. The pathons indirend with convolution durn y life. In the lungs, the own may give rate to embol aims and to small module which have become inequal ted. In sweet infection the inflammation proces may be come chronic at the lungs and lead to the d latata in of thingly ter tricle it the 'te's i, and offenth from congretion and heart affection.

In a series of necropsies in Egypt lesions of the lungs were encountered in one third and one tenth of the deaths were found to be due to this complication. Shaw and Ghareed have pointed out that the lesions are especially due to embolism by own derived from female flukes outside the lune.

They are filtered out in the artendes which accomp by the broach of producing diffuse atternal changes. Parachapterious tobules we induce containing the directive is in eggs. In some no per cost of the reace the a full women where found on their pulmonary artendes Gregors has emphasized that a rount involvement of the three rand spices in relatively commons in a mechanism of the involvement of the intestine. It is that the internal the most parachapt to taxoname produced primarily or carchapterly by in also norms. In such cases the own in the faces may be few of completely lacking T1 when has it the a accordate by the observers.

SYMPTOM ATOLOGY

Intestinal Symptoms -The ova of the parasite deposited in the submucous layer of the rectum and colon frequently gives rise to dysentene symptoms from 6 to 8 weeks after infection Pons (1937) in Puerto Rico found that initial egg extrusion into the intestine occurred from 37 to 44 days after exposure to infection. During this period there is often abdominal pain frequent stools containing blood and mucus and also lateral spined eggs. In some instances as a result of tissue read tion occurring around the ova deposited in the intestinal wall the dysen tery may become less marked or disappear for a time. However it usually recurs later At other times the movements may assume a diar rhoeal character with the evacuation of undigested food. In cases of longer standing small or large polypoid growths may be felt inside the sphincter ani They also may protrude from the rectum and may be confused with simple haemorthoids. Polypoid growths may occur in any portion of the colon as high as the sigmoid flerure. The small intes time is hardly ever affected except in the lower part. Hence in the abdom mal examination of the cases with disenteric symptoms tenderness is frequently especially marked over the caecum

General Symptoms -In the early stages of severe infections toxic symptoms may be noted. As with S haemalobium there may be an initial dermatities even though there is usually no appreciable tissue reaction at the site of entry of the skin by the cercarize General symptoms which have been noted are a remittent py revia with marked abdom inal pain anorexia rigors and pulmonary symptoms There also may be a diarrhoea suggested as due to the tovaemia On abdominal examina tion in the later stages of the disease there is frequently found an enlarge ment of the liver as well as the spleen Pronounced leucocytosis with a high cosmophilia has been reported. In cases of long standing abdominal tumors may form which are easily palpable and intestinal stasis or dis tention may occur Prolapse of the rectum and infiltration of the tissues with eggs and fistulae are common. After curbosis of the liver has developed ascites frequently occurs Deposition of the ova of the parasite in the appendix may also occur and produce symptoms of a sub acute appendicitis as described in infection with S haematobium. Vitug (1941) has found ova at autopsy in the thickened piaarachnoid and in the cortex and white matter below it. The choroid plexus showed many capillaries plugged with ova The patient suffered with convulsions and unconscious attacks during life

Symptoms of Visceral Schistosomassis —In Egypt and to a less evtent in other parts of Africa »pleamnegal very frequently follows infection with Schistosoma manzoni. In some localities 20 per cent of the infant have been found with spleus, enlargement and anamens. It is common in Egyptian peatants among the working clauses at all ages up to 30 In the young it may run a severe course while at a later age it become chrome and is frequently accompanied by secrets. This form of spleno megaly was especially described by Ferguson and Day in Egypt and by Richards in the surgical services at Carro as amounting to 21 per

cent of the cases while in a medical study 5 per cent of the admissions were due to it males being more frequently affected than females

The infection while resembling Bartis of sease usually is a sociated with fever and severe anaema. About 16 per cent of the patients noted an attack of diarrhoea or dysentery at the beginning of the illness. The usual complaint on admission was the swelling of the pleen and local pain. In most cases which had suffered for about 2 year it the enlargement of the spleen and liver was progressive causing eventually a characteristic expansion of the upper abdomen the costal angle being widely hooked out and the recti mustles separated above the umbilities while the heart was often displaced upward. There was sometimes considerable enlargement of the liver with a moderate splenomegaly. The fibrotic spleen in advanced cases may weigh 5-12 lbs. The spleen on removal is a ually found to be firm in consistence. Microscopically a general hyperplassa is evident and there is sometimes a striking phagocytosis of the red corpuscles by macrophages.

According to Dav a few ova of S measons may be present In other instances the ova may not be found in the spicen Onsi (1937) however states that failure to find ova in the spleen may be due to the fact that the spicen rapidly destroys ova deposited in it

He has recommended for the finding of ova in the calarged spleen maceration of the tissue in 20 per cent sods solution and subsequent centralization. The eggs a so often phagocytized by giant cells in disumerous cosmophile a may be precent in the tissues

pagety-tuned by gain extens in Barpoins opinioners has been seen in the special of the second of the

He thinks the splenic enlargem at is not dependent on either intestin for hepatic le ions

is 100% or some authors have emphasized that the number of over may be very million either field learn or the splean and not sail e on to account for the catenous uniform that the learn or the splean and only sail e on to account for the extensive surface, characteristic extensive characteristic extensive characteristic extensive characteristic extensive characteristic extensions and another to the preference on demandational continuous antibiodistic extensions are unable continuous antibiodistic extensions are unable extensions are unable extensions are unable extensions are unable extensions. In some unstances the lyet becomes already and adherent to the displaying millions and adherent to the displaying millions.

The symptoms of Exptions spinomegally are very varied. There may be irregular free wasting and marked vis the anaema. The spicen hard and firm may often reach to the umbaleous. The liver in the early stages is also usually enlarged. Vomiting and distribute are frequent Intermittent dysentery may also occur. Haemattemess is often present Injundice is rare. Vomiting may be a common feature. The blood picture varies at different stages of the decase. In the early stages there may be a distinct leurocyto is. Later as the anaema becomes progress were and of the chlorotic type leuropens occurs and there is frequently a mononuclear increase. The patient often succurable to the hepatic carrhosis accompanied by ascates and emaciation. Death is frequently due to pulmonary complications.

SYMPTOMATOLOGY

Intestinal Symptoms -The ora of the parasite deposited in the submucous layer of the rectum and colon frequently gives rise to dysentene symptoms from 6 to 8 weeks after infection Pons (1037) in Puerto Rico found that initial egg extrusion into the intestine occurred from 37 to 44 days after exposure to infection. During this period there is often abdominal pain frequent stools containing blood and mucus and also lateral spined eggs. In some instances as a result of tissue reac tion occurring around the ova deposited in the intestinal wall the dysen tery may become less marked or disappear for a time. However it usually recurs later At other times the movements may assume a diar rhoeal character with the evacuation of undigested food. In cases of longer standing small or large polypoid growths may be felt inside the sphincter and They also may protrude from the rectum and may be confused with simple haemorrhoids Polypoid growths may occur in any portion of the colon as high as the sigmoid flexure The small intes tine is hardly ever affected except in the loner part. Hence in the abdom mal examination of the cases with dysenteric symptoms tenderness is frequently especially marked over the caecum

General Symptoms -In the early stages of severe infections touc symptoms may be noted. As with S haemalobium there may be an initial dermatitis even though there is usually no appreciable tissue reaction at the site of entry of the skin by the cercamae General symptoms which have been noted are a remittent pyreria with marked abdom mal pain anoresia rigors and pulmonary symptoms. There also may be a diarrhoea suggested as due to the tovaemia On abdominal examina tion in the later stages of the disease there is frequently found an enlarge ment of the liver, as well as the spleen Pronounced leucocy tosis with a high cosmophilia has been reported. In cases of long standing abdominal tumors may form which are easily palpable and intestinal stasis or distention may occur Prolapse of the rectum and infiltration of the tissues with eggs and fistulae are common. After curhosis of the liver has developed ascites frequently occurs Deposition of the ova of the parasite in the appendix may also occur and produce symptoms of a sub acute appendicitis as described in infection with S. haematobium. Vitug (1941) has found ova at autopsy in the thickened piazrachnoid and in the cortex and white matter below it The choroid plexus showed many capillanes plugged with ova The prisent suffered with convulsions and unconscious attacks during life

Symptoms of Visceral Echsetosomasss—In Egypt and to a less erton in other parts of Africa splanomegal very frequently follows infection with Schristosoma mansom: In some localities 20 per cent of the infants have been found with splens, enlargement and nanema. It is comission Egyptian peasants among the working classes at all ages up to 30. In the 30 up in may run a severe course while at a later age it becomes chronic and is frequently accompanied by sacits. This form of spleno megaly was especially described by Ferguson and Day, in Egypt and by Richards in the surgical services at Carn as amounting to 42 per

believe that infection with S mansons is more difficult to cure than that with S harmatobium

Zye and others have employed rectal injections of tartar emetic and reported that they are especially advisable for small children who take to grains by rectum (r grm) without fouce effects. The amount of the drug absorbed is not known.

Five to seven daily injections have been recommended.

Khall has employed foundin extensively in the form of intramuscular impertuns but it has not appeared to be as efficacious as tartar emetic. A few cases of sudden death occurred after treatment and he helieves that idnoy acrasses to the drug may occur. The rate of renal excretion is most important and any degree of kidney damage is a contrainful cation to its use. Usually after 5 impections only dead on a were found in the facees. According to Egyptian statistics in 1934 of the total number of cases which received 9 or more impections of Foundain number ing 1938 fifty three per cent were cured 2 impections and the reminider required even more. After 13 injections signs of drug intolerance were noted. I shall had relapses in 35 per cent of his cases.

Emetun has also been recommended as efficacious. Maciel has recom mental a injections being 3g and the remainder 1gr. Emetun treat ment is advised for those patients for whom animony treatment seems madvisable.

Operative Treatment -In advanced cases with ascites the injury to the liver obviously cannot be repaired by specific treatment. Tapping of the abdomen is frequently necessary for relief of the symptoms due to ascites In early cases before the development of ascites Richards Coleman Bateman and Stiven have recommended splenectomy for the relief of the splenomegaly and accompanying symptoms However the mortality rate in some series has been about 15 per cent. Some of the deaths were due to late shock. Stiven emphasizes that there should he great care in the selection and preparation of the cases for operation Ascites beart disease and debility are contraindicative. Five or six weeks treatment preliminary to operation is advisable. The weight of the spleens removed by him averaged 334 lbs The favorable effects appeared in many of these cases to be permanent and ascites did not develop In the early stages Day has found that the splenomegaly may be favorably influenced and the accompanying symptoms disappear after tartar emetic In cases with extensive disease of the rectum surgical treatment with excision is frequently advisable

Prophylaxis — The problems relating to the prevention and control of the disease are practically the same as have been outlined for S haema tobusm infection on p. 1413

III Schistosomiasis Produced by Schistosoma Japonicum

Synonyms -- Katayama disease Oriental schistosomiasis

Definition —A chronic disease produced by Schislosoma japonicum characterized by chronic dysentery great enlargement of the liver and

Pulmonary Complications -- Pons (1937) in Puerto Rico found cough invariably present in the early cases and tenderness over the liver spleen and intestines

Mainzer (1930) who made a study of serial radiographs in Alexandria found that in infection with S mansons latent pulmonary in objenent is usually present even in cases with no clinical pulmonary symptoms and that it becomes apparent about 3 months after infection

He describes the 1 ray appearance of the pulmonary lesions as consisting of distinct foci varying in size density and distribution increased striation and unchanged and intensified hilar shadous. Cough fever and wasting may simulate tuberculosis and after the destruction of the parasites contracting fibrosis may constrict the broncholes or vesicles. He believes however that bilbarrial asthma is an allergic phenomeron depending upon the constitutional factors and substances liberated by S haemotobiam or S mansons It does not depend on lessons of the lungs brought about by the para site ince pulmonary infection is constantly found in schi tosomiasis and the ader ic nature of the condition is shown by its association with princaria and by its hereditary transmission. That it is due to Schistosome infection is demonstrated by the parallel in of the course of the a conditions and its disappearance after sp cube therapy

Among the tarer complications thrombosis of the portal vem and carcinoma of the liver have been recorded. The disease is usually chronic and may last 20 years or more Magalhaes and Coelho (1018) found in Brazil 8 cases of fiver circho is with primary cancer In 5 of these Schistosoma monsons were pres ne and ova were encysted in the

connective to sue They think the effect due to the toxies of the parasite

PROG JOSES

As in infection with S haematobium, it is very variable. In mild infections it is good and in such cases the disease is frequently successfully treated In the cases with hepatic cirrhosis or splenomegaly accompanied by ascites the prognous is unfavorable and the patients are not usually greatly improved even by intensive treatment with antimony. In such instances the disease is usually chronic and some of the patients may live for years In cases with ulceration of the intestine, extensive papillomata of the rectum and dy entery the prognosis is usually unfavorable Death as also sometimes due to pulmonary complications

The diagnosis of Schistosoma mansons infection is made by firding the characteristic lateral spined eggs in the faeces. They may be seen under a low power of the microscope. In about 5 per cent of the case in Egypt ova may be found in the urine as well as in the faeces. In disen teric cases it is usually unnecessary to use concentration methods for the discovery of the ova Scott (1937) recommends that 3 routine faecal slide examinations be made and that such examinations must be supplemented by sedimentation. He found rectal snabs to be especially efficient for the recovery of the eggs. If only male worms are present in the infection, no ova will obviously be found in the dejecta. In such infections the examination of the serum by the complement fixation test with a trematodal antigen may be of assistance (See D 1412)

TREATMENT AND PROPERLANTS

Treatment is similar to that outlined for Schistosoma haemalobium (see p 1415) On account of the extensive in obsement of the liver which may be present in the infection with S mansons it should be borne in mind that intolerance to antimony may be great. Some observers stouter than in these species. The stakes measure 12-10 mm. The citaties is relitively smooth but it coverted with annute assumants apairs. Their sides twich more markedly than do those of the preceding species. Usually 7 testes can be do inquished. The femiles average about 15 mm in sheepft and their integement is also covered with counter somes. The overy less just posternet to the middle of the body. The utress of the body is the proper of the state of the middle of the body I all the properties of the state of the state of the state of the counter of oval transparent and when passed in the faces measure about 70-90s by 50-60. They have a smooth is live to usually show a rudementary or lateral space of knob near one end. Red blood cells and other trasse cells are sometimes a en adherent to the shell. The eggs are stretted only in the faces.

Transmission.—The eggs when passed in the facces are usually mature and when water is added to the facces they hatch the minicidum escaping through a rent in the shell and swimming about in the water it cleavely resembles that of S hormatohium and differs only in its some what smaller size and in certain morate internal structures

On recking a suitable small it meles has old insures of the mollius; and in the course of g y needs underson a work follow multiplicative process with the successive production of that and second gove ation approxysts with typical forched failed creature the structure of which also at insure it destincts with that of S is must have and S is must not an amount of the contract with the sain of the many and the creature is posteriar tone gland? In contract with the sain of the many and the creature is one that it is an an interest to the spin of the skin and eater the removas or cultation being carried through the night beset to the larger and thence to be palmonary capillaries and the left heast not the systemic circulation. According to palmonary capillaries and the left heast not the systemic circulation. According to the state of the sain and thence to the spin on a state of the sain and the sain the mestion of the sain and th

Mollusgan Hosts —The appropriate manh shich are known to serve as the intermediate boat for S appen was no Japan and along the coast of Claims are according to Bartish (1936) winness species of Oncombine a Lottycene and Schitzbarneph refaces to as the following Lottycene in softer an Inpan and along the coast of Claims K for me as in Formers. One melan a Information the Nameter Basin O. And observation, Bland is agained as in keyler. Philippine Basined. There is will much discussion, about the nomenciature of some of three species. Small of this group are only 7-10 mm for with him beauth delike and are one considered.

EPIDEMIOLOGY

CLIDE MIOTOR.

The parasite is by no means confined to man but infects naturally cats dogs eatile horses and pie goats and abeep among domestic normals and also field more and water budfalots are also impostant reservoir hosts in certain endemic foot (1940) reports that congenital infections have occasionally been recorded for man

The disease is acquired by man similarly as in S masson infection by direct contact with infected water containing the cercange

PATHOLOGY AND SYMPTOMATOLOGY

The course of the disease may be divided into 3 stages (1) the incubation period in which utricitated pulmonancy and feler insumification one may be present. This stage may last for about a month (2) that of disposition and exitus on when the owa appear in the bloody mucus stoble and (2) the period of latther tissue destruction and prolifer atom which may be eventually characterized by cardious of the liver arcites cachests and draith

B nac (1942) I at in the Celebes found that the village dogs used in hunting pigs were infected with S 100 mg um as were the wild deer

spleen, and subsequent development of ascites, anaemia and a terminal currhosis of the liver

HISTORY AND GEOGRAPHICAL DISTRIBUTION

History—The duesaes was apparently first mentioned by Fuji in Japan in 1817 and for many years was recognized as an endemic infection characterized by enlargement of the liver splenomegaly active cachesia and dysentene symptoms. Majama in 1836 found ow an a cirribotic heave and in 1902 Fujiman discovered the adult treated S japanica in the portal veins of a cal. Katsurada succeeded in communicating the infection to cats by immersing their legs in the water of certain ponds said to convey the disease and first found the adult parasities in infected dogs and cats. The experimental work of Fujimanu Myagawa and especially of Mijariar and Sunia (1913-4) death ware of Irilana and Myagawa and especially of Higharia and Sunia (1913-4) death strategies the first production of man an observation confirmed the following year by Leiper and Atkinson fection of man an observation confirmed the following year by Leiper and Atkinson



Fig. 341—Egg of Sch. tosoma japonicum conta ming the cl. t d larva - r mirac d um from fresh facces of man (Photo Pathological Institute Batavia Java)

Geographical Distribution—Its distribution is apparently confined to the Far East. It is common in certain districts in China and practically the whole Yangtse valley is infected. Faust has estimated that in China tens of millions of people are yearly exposed to infection.

In addition to the \(^1\) angise basis the coastal area and the Melong sulley are strong andemie for Recently as nedimic center has been reported at Shuchow on the north river, their Canton and also at Foothow (Tuken). It has also been found on the Burneste border. In Japan, a comparatively small lost are known it being especially prevalent in the province of Hiroshima and in the vullage of Katayama. The disease has also been found in Formous and in the touthern Philippine Islands of Leyte Samar and Mindanso. An area of infection has also been found by Brug and Tesch (1937) in the Celebra.

in the Celeves

Morphology—The parasites resemble S haematobium and S mansons but lack the
tuberculations of the integument Also the acetabulum or ventral sucker is larger and

stouter than in these species. The males measure 23-20 mm. The cuticle is relatively smooth but is covered with minute atuminate apines. Their sides anfold more markedly than no those of the preceeding species. Usually 7 testes can be dis tinguished The females average about 25 mm so length and their integument is also covered with minute somes The overy her just posterior to the middle of the body In both sexes the gut branches recente in the posterior fack of the body. The uterus consists of a long straight tube containing as many as 50 ova at one time. The ova are oval transparent and when passed in the faces measure about 70-004 by 50-60 They have a smooth shell but usually show a rudsmentary or lateral smale or knob near one end Red blood cells and other tissue cells are sometimes seen adherent to the shell The eggs are excreted only to the facces

Transmission -The eggs when passed in the faeces are usually mature and when vater is added to the facces they hatch the miracidium escaping through a rent in the shell and saimming about in the water It closely resembles that of S haematobium and differs only in its some what smaller size and in certain minute internal structures

On reaching a suitable small it enters the soft tissues of the moliuse and in the course of 5 7 weeks undergoes a two fold multiplicative process with the successive production of hist and second generation sporocysts with typical torked tailed cercarize the struc ture of which also is almost identical with that of S he mat b um and S menson important differentiating characteristic however is the presence of 5 pairs of penetra tron slands. On contact with the skin of the mammal the cercarize lose their tails and in the course of a short time penetrate into the capillanes of the skin and enter the venous or culation being carried through the right heart to the lungs and thence to the pulmonary capillaries and the left beart into the systemic circulation. According to Faust (1040) only the wand viduals which reach the intra hepatic portal circulation via the mesenteric artery and capillaries grow and migrate out to the venules of the superior and mesentene vessel. Within 5 weeks the parasites have mated and the temples are laving ova-

Molloscan Rosts - The appropriate souls which are known to serve as the inter mediate boot for S , possesses in Japan and along the coast of China are according to Bartsch (1936) various species of Oncomelon a Latayama and Schrilesomophera Faust lists the following Ladoyama nesofters in Japan and along the coast of China K f me a a in Formesa Oncomelanta hugenss in the Yangise Basin O hyd objectiss (Syn Blan die guadrasi) in Levie Philippine Islands There is still much discussion about the nomenclature of some of these species. Smalls of this group are only 7-10 mm. long with high spi ed shells and are operculated

Expendictory

The parasite is by no means confined to main but inferts naturally cats does cattle horses and pigs goats and sheep among domestic animals and also field mi e and water buffalors are also important reservoir books in certain endemic foct (1040) rep stathat conceptal infections have occasionally been recorded for man The disease is acquired by man similarly as in S monion infiction by direct con

tact with infected water contamine the cercariae

PATHOLOGY AND SYMPTOMATOLOGY

The course of the disease may be divided into 3 stages (1) the incubation period in which orticanal pulmonary and febrile man I stations may be present. This stage may last for about a month (2) that of deposition and extrusion when the new appear in the bloody mucus stools and (3) the period of further tissue destruction and prolifer ation which may be eventually characterised by our home of the liver ascites cachena and death

B one (942) I also the C lebes found that the village dogs used in hunting bigs were infected with S soponi um as were the wild deer

spleen and subsequent development of ascites anaemia and a terminal circhosis of the liver

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Fig. 341—E_kg of Sch stosoma paponicum containing the c hated larva or in racidium from fr sh facces of man. (Photo Pathological Institute Batavia Java.)

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Morphology - The parasites resemble 5 assembles and 5 mansons but lack the tuberculations of the integument. Also the acetabulum or ventral sucker is larger and

These symptoms are apparently dne not only to the infiltration of the ova in the tissues of the intestinal wall but into the periportal tissues of the liver and other organs where pseudotubercles and abscesses may develop around the ova Hoeppli believes that the irritation caused by the eggs is not only mechanical but chemical as well and that the discharge of secretions occurs through the shells of the eggs still lodged in the tissues Giant cells frequently develop within the pseudo tubercles which later become encapsulated by fibrous tissue. In the liver spleen and lymph nodes endothelial cells are frequently seen containing haematin pigment During these inflammatory changes in the liver and spleen the fibrous reticulum becomes increased and these organs gradually become greatly enlarged The mesenteric lymph nodes also become swollen Changes in the viscera are usually much more marked in Schistosoma japonicum infection than in that due to Schistosoma mansons because the infections with the former are usually much more severe and the daily output of eggs by the corresponding parasites is much greater. Also there is greater proximity of the parasites to the liver when they are present in the superior mesenteric veins

The third period of tissue proliferation gradually develops. The liver gradually diminishes in size as its parenchyma cells are replaced by fibrous tissue. The spleen however continues to enlarge especially of account of the circulatory congestion. Ascites is a very common develop ment and especially depends upon the amount of bepatic cirrious. In the bowel wall abscesses frequently develop around clusters of the oxa with the development of papillomats and later ulcerations are formed Finally the intestinal wall may become greatly increased in thickness and

later on contractions from fibrosis may occur

The male and female worms are often found together in the distended vans of the submucosa for in this species the females do not leave the synocoporic canal of the male when laying eggs but merely move forward in it (Chandler 1040)

When the intestinal walls become thickened more and more ova are swept back into the liver Yamagiwa has pointed out that the ova may cause embolic closure of the portal vessels and may serve as an additional factor in the production of the portal cirrhosis. In some instances the ova may reach the lungs bladder or even the capillaries of the brain They have also been found in the lymph nodes Africa and Santa Cruz (1939) have also found the ova in the myocardium where a large number of eggs were found in typical pseudotubercles in the intraventricular septum of the heart Sections of the heart showed under the low power a close resemblance to tuberculosis on account of the presence of numerous giant cells. Ova were also found in the intestinal wall liver lungs kid neys and brain of this case Jacksonian fits bemiplegia and even total blindness as the result of deposition of the ova in the central cortex and destruction of the visual centers have been reported Garcia has found the ova in the tissues of a chronic ulcer of the leg of a child in the Philip pines Ova were also present in the faeces

The third or final stage of the disease may not occur until 3 to 5 years after infection When the liver and spleen become markedly cirrbotic

In the first stage there may be beadache and an evening rise of temperature to about 102°F or 102°F Shortly after the onset, uticanal lesions sometimes 5 or 6 centimeters in diameter may appear and dis

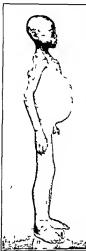


Fig 342—Cas of Sch stosom joponic m Severe infe tion of three ye rs duration Ova very abundant in tools Liver dulin s dim inshed (Spieen not enlarged (From Jefferys and Maxw B)

appear on various parts of the body. The condition has been termed kabure. The curticarial rash, accompanied by fever may develop as early, as the fifth day after exposure. It may be accompanied by oedema of the subcutaneous tissues and the wheals may be present both in the skin and sometimes in the mucous membranes. The pulse rate is usually low Very characteristic and early manifestations are those of pulmonary involvement. Here oedematous patches may give on auscultation signs of crepitation and consolidation and these may, rapidly disappear and reappear in another part of the lungs.

The pulmonary manufestations and as sociated fever sometimes have caused a diagnosis of broncho pneumonia to be made. A dry hacking cough appears early and with the fever may cause one to think of tuberculosis. The uticarial lesions have caused a diagnosis of ptomaine poisoning to be made. The blood examination may show a leucocytosis and a marked coainophilia of from 30 to 60 per cent. A toxic diarrhoea generally develops toward the end of this period.

The second period, beginning with the deposition of the eggs in the itsuses comprising the wall of the intestine and their discharge roto the lumen of the bowel is frequently accompanied by a profuse dysentery. The eggs in the facees are sometimes surrounded by a layer of cellular dehris. At this period, there may be recurrent days fever expansive pum with tenderness over the abdomen and large tender liver and spleen and loss of appetite and weight. The acute attack often terment the face of the numbers and the other.

minates in from 3 to 10 weeks when the fever often subsides and the other 5 imptoms ameliorate. Exercise may cause exactehation of the intestinal symptoms. The blood picture frequently changes from that of the previous one of leutocytosis and cosmophila to that of a secondary anaema with erythropian leutopenia and reduction in the cosmophic count

These symptoms are apparently due not only to the infiltration of the ova in the tissues of the intestinal wall but into the periportal tissues of the liver and other organs where pseudotuhercles and abscesses may develop around the ova Hoepple believes that the irritation caused by the eggs is not only mechanical but chemical as well and that the discharge of secretions occurs through the shells of the eggs still lodged in the tissues Giant cells frequently develop within the pseudo tubercles which later become encapsulated by fibrous tissue. In the liver spleen and lymph nodes endothelial cells are frequently seen containing haematin pigment During these inflammatory changes in the liver and spleen the fibrous reticulum becomes increased and these organs gradually become greatly enlarged The mesenteric lymph nodes also become swollen Changes in the viscera are usually much more marked in Schistosoma japonicum infection than in that due to Schistosoma manson: because the infections with the former are usually much more severe and the daily output of eggs hy the corresponding parasites is much greater. Also there is greater proximity of the parasites to the liver when they are present in the superior mesenteric veins

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The third or final stage of the disease may not occur until 3 to 5 years after infection. When the liver and spleen hecome markedly curriotic

ascites and oedema of the extremities is common together with anaemia and exacerbations of the dysenteric symptoms The patient may finally die of exhaustion or some terminal infection

PROCMOSIS

In severe infections with S japonicum the prognosis is unfavorable unless treatment can be given fairly early in the disease and before the visceral lesions are well advanced. In fact in very advanced stages with cirrhosis of the liver and splenomegaly and ascites treatment is usually meffective and the patient eventually dies of exhaustion or some terminal nfection

DIAGNOSIS

Specific diagnosis depends upon the discovery of the characteristic They are often found in the adherent mucus When ova in the faeces not numerous the faeces may be emulsified, strained, and sedimented and the sediment examined for ova Flotation methods are unsatisfactory

Fülleborn suggested washing the sediment 2 or 3 times with 2 5 per cent salt solution and each time allowing the eggs to sediment 5 minutes in the dark and decanting the fluid. Then distilled water is added to the preparation and exposed to the light at a temperature of 120 f. The miracidia batch quickly and by using a band lens may be seen awimming about near the surface. Those of S haematobium however do not rise to the surface

In the first stage of the disease the eggs may not be present in the faeces In such instances a positive compliment fixation test as devised by Fairley and described under S haematobium diagnosis may be of value

The presence of cosmophilia and evidence that the patient has lived

in an endemic area may also suggest the diagnosis

In later stages of the disease where the ova cannot be found in the stool Faust and Meleney have suggested that the aldehyde or serum globulin test is strongly positive in many cases

The disease in its terminal stages must be differentiated from Banti s disease and from Kala azar The dysentery must be distinguished especially from the amoebic or bacillar; form and from intestinal tuber culosis The hepatic symptoms may sometimes suggest amoebic liver abscess

TREATMENT

Treatment with antimony tartrate has been found equally efficacious in killing off the adult parasites as in the case of S haematohium infection According to Faust and Meleney 22-30 gr of intravenous tartar emetic over a period of 18-20 days is usually curative in the early stages of the infection Cawston first reported inframuscular injections of the sodium salt as successful in the treatment of schistosomiasis of Asiatic origin Since antimony by vein is contra indicated in patients with advanced hepatic cirrhosis as well as in those with anemia heart disease or nephritis it may be more advisable to employ emetin hy drochloride in some cases

As a result of the experimental studies on S spindalss infection of the goat Fairley found that emetin given intravenously in 10-15 injections varying between 0 7 and r mg per kilo of body weight caused the rapid death of the parasites and was more efficacious than tartar emetic

Tyskalas claims that emetin given intrave nously in doses of 1/2 gr daily for 10-14 days is superior to every other specific. However torue symptoms diarrhoea vomiting and neuritis are

apt to occur

Fairley also found in goats that fatal verminous thrombosis of the pancreatic and portal veins might occur as the result of the presence of dead parasites

In the treatment of the splenomegaly splenec tomy has been employed to some extent but so far with little success as in most cases the hepatic cirrhosis has usually been well advanced at the time of the operation

PREVENTION

The disease is princarily confined to rice farmers and canal boat men in the endemic areas in the Far East. However persons bathing or wading in the irrigation ditches canals and pools are also exposed and may contract the infection. Sports men occasionally become infected in single shooting in the endemic areas. The urban population are not seriously endangered except when through flood the infected snails may pass through and cutter. It should be borne in mind also that dogs and cattle in Clima may serve as reservors and in Japan field mice may be important sources of infection.

For prophylatus the water suspected of being capable of causing the disease should be boiled or avoided for drinking or bathing purposes. Sports men and others finding it necessary to wade in such water should wear long boots. The sterilization or sanitary disposal of the faces of the cases of schistosomians should be carried out where proposed in the sterilization of the same dut where proposed in the same disposal of the sa

tion or sanitary disposal of the facers of the cases. The certains of oschistosomass should be carried out where practicable The certains die in 3 to 4 days in stored water. The control problem is more complicated than in schistosomass due to 5 mension on account of the common use of human might soil for fertilizer in most of the endemic areas. Attempts should be made to allow the night soil to prien longer in containers or to disinfect it with fertilizer salts as ammonium mitrate in order to full the owa before the fertilizer is spread on the fields.



Fig 343—Col n from a case of J p n s s h tom h w ng a ma ked polypo d cond t n of th nt t n lunu a (Army Med 1 Mu um ph to N 39343)

Another important point in the control measures relates to the type of snail All the species that serve as the intermediate host are amphibious in habits and can withstand desiccation for a month or more. In cir cumscribed endemic areas the Japanese have reported some success in climinating the snails by spraying them with live steam and by lining the irrigation ditches According to Naragayashi lime in a solution of 1 1000 is the most economical reagent for the extermination of the snails and kills the cercariae in 30 minutes. In the very extensive endemic regions in China however the actual location of the infected snails is rarely known and hence antimolluscan campaigns are not practicable

RARER SCHISTOSOMAL INFECTIOUS OF MAN

Schistosoma bowis (Sonsino 1876) syn S matther (Veglia and LaRoux 1939) S curassons and S rodhaina (Brumpt 1931) is a not uncommon parasite for sheep goats eattle and other herbytorous animals in Africa southern Asia and parts of southern Europe It has been reported for man in a few instances in the Belgian Congo Southern Rhodesis and Vatal The eggs are discharged in the facces and resemble those of S haematobium but are usually longer and narrower measuring according to Price 160-1804 long by 46-704 Unlike S haemolobium this species apparently affects only the intestines The intermediate snail bosts are the same as those for S has metablum Dodesnell 1938 has found that in Kenya Colony Physopsis natulo is succeptible to infection

Schistosoma spindale (Montgomery 1936) is a common parasite of cattle sheep and goats especially in Incha and the Fast Indies and in South Africa It develops in a species of Planords. The parasite sometimes inhabits the mesenteric veins of animals and sometimes causes a snoring disease in cattle where by its localization in the nose it produces lesions somewhat similar to those in the intestine or uninary system A few cases of human infection have been reported in South Africa, where ove were found in the patient's utine The o's of S theadas are spindle shaped and often fat tened or bowed on one sade. The measurements which have been given by I suit (1940) are from 364-400% an length by 68-72 in width Porter gives the measurements of those she found in the tirine of man as 163-258µ long by 46-70µ wide

Schistosoma intercalatum (Fisher 1934) - Chesterman pointed out that at lakusu near Stanleyville in the Belgian Congo int stinal bilbarriasis is the only form of the disease which occurred and that the cases showed only terminal pined eggs somewhat mote elongated than those typical of S hematob in lisher who studied these ova believed they belong to a different species. He found the ova relatively longer and more slender with a well developed spine and that th y might attain a length of 2004 The terminal spined ava found in facces in the Belgian Congo by the writer and Sand ground measured betwen 162 and 1694 in length and from 54 to 644 in width. Thus they were only very slightly longer than the measurements given by Price for Schisto some hemetobium eggs 120 to 160m in length by 40 to 60m in width and they are evi dently much shorter than the own of S spendalis Van den Berghe (1939) has found variations in the shape and size of the eggs of S sutercalulum and states that they barely exceed in size those of S haematobium. He believes that its local geographical dis tribution and its limitation to the intestane would seem to be the only factors justifying its being placed in a subspecies

In Yakusu the parasate has been reported to infect about 50 per cent of school The symptoms are usually of mild dysentery abdominal pain being only rarely complained of Honever sigmoidoscopic examination in some cases has revealed

sandy patches but neither polyps or ulcers have been noted

S incognitum - Chandler (1926) has reported a small Sch slosome egg with a subterminal spine in supposedly human facces in Ir dia Both the eggs which were or ordal and the parasites themselves were subsequently found by Saunders (1954) in Indian oigs

SCHISTOSOMA DERMATITIS

When the cercariae of the human Schistosomes or the Schistosomes of some other animals penetrate the skin they may or may not cause an tiching rash or a dermatitis. In Puerto Rico S manson may cause a severe pricking sensation when penetrating but usually no subsequent rash. In Egypt as noted both S manson and harmaloisium and in the Far East S paponicum are known to produce urticana or itching papules and sometimes ordema. In the Far East however S japonicum frequently gives note too be dermatitis.

quently gives rise to no dermatitis.

Cort (1978) however demonstrated that certain non human Schistosome larvae incapable of infecting man will nevertheless cause a severe
dermatitis or swinners it the when they penetrate the skin of bathers or
waders. As the water-evaporated from the skin a pricking sensation was
experienced followed by urticarial wheels. After about half an hour the
initial dermatitis subwide lawling only a few macules. However several
hours later intense itching developed with oederia and the transformation
of a number of the pripiles into pustules. The reaction was most intense
between the second and third day following exposure. The condition
was first observed in Michigan and was found to be common in certain
other pirts of the north central states and southern Canada. It has also
been noted in Germany Franca and Wales while in the Federated Malay
States. Buckley (1938) has also observed an itching dermatitis in the
paddy workers.

At least 8 species of cercanic are known to go e time to these symptoms. Some home er occur only in marshes a d are of no importance. In Michigan C phorell and C singuistic of Europe C cedifies and not the Main's Matter cercanic of S and C singuistic cercanic of S and C singuistic producing species develop in smalls of the genus Lymens on in Physical Conservations and the producing species develop in smalls of the genus Lymens on in Physical Conservations.

The affection has attracted increasing attention in the United States particularly in the lake regions of the north central areas in Wisconsin Michigan and Manitoba Brackett (1940) has found that outbreaks of the disease occur most commonly in July and August although they are occasionally encountered eather or later in the summer.

Not all persons are suscept ble Children have been more commonly affected pe haps been use their activities in shallower water bring them into contact with more coraria and maddition, they may be more sens they than adults.

Climically a 4s minutes after emerging from infected matter at againg a man of stellar three spools quarted rise body. Shortly free of purpor last q def manciles may appe r. The tingling may then who de and noth g be experienced for a numbe of hours. Then a 6s then their getpens and the manciles entage to form firm discrete papules from x-5 mm in diameter. They are red first but my be urrounded by a halo of hyperienam Occas onally the less in become pustular. Secondary infections may cause certain v. attoos. In those vry suc public urternal wheals may arise soon after these ce crane invade the sum. The cleans usually if whithin a week.

The e tremit es are most frequently involved and the face and neck are usually soared Vogel (930) has experimentally infected himself a d volunteers with a European so cise (Cercor occiliato) which is closely related to the Schiitstonne cercaiae of the United States Twenty four hours later be removed some of the tissue for histolog call.

study. In one instance are cereatine were found in the trisue, which has sectioned serially. The practisets were found lying no tunoels in the optical layer and were till easily recognized. Brackett has also made histological studies in which the nair surface of the forearm was exposed to C of a Bugoy was performed after so again after so hours. He observed momerous burrows in the epithelium and evidence of an acute inflammatory reaction but was unable to find any cereation included believes the cereative were absent in his tissues not because they had gone deeper of been overlooked but because they were destroyed so hours after they had entired Biackett found evidences of an acute inflammatory reaction around the tinnels while the cereative had apparently temporarily occupied. The acute to administry reports to the presence of the cereative was evidenced by pronounced oedens and extensive acity inflitration of neutrophiles and lymphocytes. Later extensive invasions we consophiles occurred. Clinically evidence suggested that recovery this follows roundly

Brackett's observations show that the dermatitis producing schistosome cercanae of the United States do not continue their development to the skin or set up a systemic

infection in man

In order to obtain information concerning the suitability of primate as hosts of Schutzenshizim doubtili (Cort, 1914) Brackett exposed the extremites and fixed of young female rheaus monkey to the penetration of cercaine and noted a very mild dermatitis on the exposed areas. There weeks after the last exposure the animal was autopsied but no trace of the schitstoome infection was seen. He assumed that if this parasite which develops readily in a wide variety of laboratory animals developed readily in man at probably would have been found in the one monkey used

More recently Tenner (1941) has exposed 3 rhesus monkeys at disterest times of the pear to the certains of Schulstownshum domhits. In the first, the exposure were light and a mild derimititie was produced. The monkey was autopsied a weeks after the last exposure and on complete and careful examination was Jound negative for Schulstoma. The second young monkey was submitted to sevele certain exposure the number being estimated at 15 000. He showed spins of distress and scratched himself considerably from a short time after exposure until the time of the autopy 5/6 days later. A marked derimitities was those outdent. On autopy the ingrating worms were found to be abundant in the luops and slight haemorrhages were noted. The third experiment in a rhesus ronchey showed that a mild derimatities developed which rapidly disappeared. An autopsy could not be conducted on this animal to set if further development occurred. Penner suggests that the one positive experiment suggests the possibility of penetration of the skin of children who swim in intested areas where the exercitate are abundant.

Treatment—After penetration the only possible treatment is by sompting applications. Brackett (1939) recommends as a useful proph) lactic wiping with a towel immediately after coming from infested water since apparently the cercarine penetrate the skin of human beings largely in our entirely when the water has evaporated.

Prevention — Cort and others have reported a satisfactory elimination of the snails from certain districts by an initial dose of copper sulphate at a concentration of 2 parts per million. It may be necessary to treat the body of water again at regular intervals since after each treatment sometimes snails have been found indicating that at least some of them resisted one or several exposures to the chemical

Brackett has suggested the ose of copper carbonate on account of its low solubility. He points out that even in the presence of an excess of the compound there might be enough copper, an solution to kill smalls but not enough to myne sich life. Copper subnate or copper carbonate has been excommended for the destruction of the anna in small holdes of water. No practical method for its see loating lakes is known

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study. In one instance, or certaints were found in the tits us, which was sectioned senally. The parasitest were found from the months in the epithelial layer and were still easily recognized. Birackett has also made histological studies in which the most surface of the forstarm was exposed to C fast and the epithelium and ovidence again after 50 hours. He observed momentous human by the epithelium and ovidence of an acute inflammatory reaction but was unable to the entry had gone deeper of the entry that the control of the entry that the control of the entry that the parasite of the entry that the entry that the parasite of the entry that the entry

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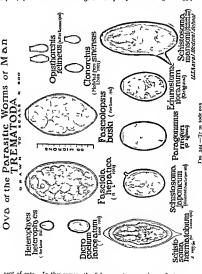
More recently Penner (1941) has exposed 3 rheus monkeys at different times of the year to the eccentuse of Schaissessatium doubilit. In the first the exposures were light and a mild dermatitis was produced. The monkey was autoput d.4 weeks after the last exposure and on complete and careful examusation was found negative for Schiistesma. The second young monkey was submitted to severe cerearial exposure the number being estimated at 30 soo. He showed signs of datriers and scratched himself considerably from a short time after exposure until the time of the autopay 35f days later. A marked dermatitis was then evident On autopay the migratir worms were found to be abundant in the lungs and slight hatmorrhages were noted. The third experiment in a rheast monkey showed that a mild dermatitis developed which rapidly disappeared. An autopay could not be conducted on this ainual to ret if further development occurred. Penner suggests that the one positive experiment suggests the possibility of penetration of the akin of children who was min infected areas where the externate are abundant.

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Houdemer (1934) more recently called attention to the prevalence of clonorchiasis in Annam He found the infection locally present in from 1 4 to 40 per cent of human beings in nearly 11 per cent of dogs and 33 per



cent of cats. In this region the fish are eaten raw being first cut into pieces 1-4 cm long. The small species of Carrasus auralus usually swims about in a howl beade the undividual when eating. From this bowl the fish is caught up with a small scoop and the native after season ing it eats it while it is still wrighing.

The extent to which the infection with Closerchip occurs in India is not entirely clear. A few cases of human infection have been reported there and Chandler found infection very common in cats and dogs in eastern India. But did not find it in man action observed Closerchie vois in the faces of a Indian solders in Mesopotama and Bagchi (1934) has reported a case of infection in a Mohammedan in Patra. Diagnoss was made by finding the own in the stools and comparing these with authentic sections of own of Clonerchii streams? He points out that sume Indians seldom at uncooled of the control of the cont

Bindred (1934) has reported upon the occurrence of Comprehe ova in the stooled a legers none of whom had ever been outside of the Tentrory of Havan. He alloids to the fact that up to 1977 alreas with Classreks infection were excluded from Havan Sonce this time however the regulation has been relaxed. He state that large quantities of frozen dired salted and prelied fish are imported into the Havanian Manhat Cyprindea are known habories of this infection and that is of the 4 infected per sons had eaten raw gold fish (Cyprindea) caught in the artificial tane poods. In 1907–1905 Some 24 cases of infection with Chemochia primary (Dysiloriks incessi Blanchard 1895) were reported in the Philippines Islands in Chinese and Filippine (forms Musiqueva and Hersel). Whether the disease is endemic in the Manha

appears doubtful

Itmenant cases of the disease have not infrequently been reported in large scaports. Thus Mayer in 1916 found Ctoneroles innexes you in a 0 per cent of 100 Choice saidn who were at the time Would May prisoners in Hamburg. Prof to 1971 it was also shown that in the neighborhood of 50 per cent of the Chine e cooles examined by the public bealth officers in San Francisco were indected with the own of this parasite and Shattuck (1913) showed that 54 cases occurred in Boston in Chinese immigraots and in a few Japanese.

The observations of Davis (1922) are of some interest in demonstrating the absence of the infection in Brail. Thus at the Yellow Fever Laboiatory in Babia a micro scopical examination was made of sections of pieces of the liver (obtained by the viscerotome) from 25 503 persons who had died in central and northern Brail. That examination is revealed that the presence of the own of no other flux was noted except.

of Schistosoma mansons

Formerly immigrants found to be infected with the ova of Clonorchis sinensis on arrival in the United States were not admitted. Since how ever, it is clear from a study of the life cycle of the parasite that there is no likelihood of the infection spreading in this country this regulation has been resembled.

Life History and Eulology —Chowechis amenia; inhalts the hile passages (and occasionally the panegrated ducts) of man and several other mammals modding the cit dogs pig rat and mouse. The finke is no to 15 mm long 2 to 5 mm broad ponned anterrolly and somewhat rounded posterondy. The integrament a supposur. The roll sucker is slightly larger than the vestral which is attacked at the posteror of the anterior third of the body. The none characteristic features are the office of the total control of the control of

The ova in the faces are oval yellowsh brown structures 27-15a long by 11-20 broad. They contain a chiated muracidum when passed. This is not herated until the erg is ingested by the soul. Figs may be numerous in bile obtained through a

duodenal tube even though sparse in the facces

Transmission.—The yellowith howen over of Clemerchia internits are passed in the exercist of man or other infected mammals and nest submost ready to that when they leave the mammalian host. Both Saito and Wayson found that under unusual circum stances apontaneous hatching of Clemerchia over may occur. Other observers and particularly Faust have shown th I batching of the ova does not take place normally onts de the body of the appropriate molliscans have and in normal development it is necessary for the embryonated egg to be swillowed by the small. Faust (1930) has shown that the smalls which act as the first intermediate host for this fulle are instituted to a ungle subfamily the Billymmen which are represented by four spocess in the Simo Japanese area. we Fausty survival at this Promessis Billyma Queka on and Boingtorns: The ova after being injected by these mails hatch in the ocupit gus of the molligate the mot clouds practicating through the gut wall into the pero-cosphagus of

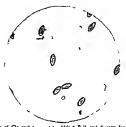


Fig. 345 -Ova of Clo orch : s: (Aft r B N and Sutton from Jeff ye and M w N)

Jymph space where it metamorphoses into a sporecyal magnetic towards the interhispate lymph sames — dither period cas a progregor deredat. These latter in turn produce cercainse. The mature cercainse effect a rupture first in the tissues of the reduce them in the tast outer turns to specific the modifice excepting into the water reduce them in the tast outer turns to specific the modifice excepting into the water cercains penetrate under the scales and note the first both the first in the measures due carding their cutual appendages.

Faust and Khaw found that practically every species of fresh water fish in China Japan Korea Formosa, and French Indo China could get e as the second intermediate host for the sparasite. Some 40 species of fresh water fish of the families CYPRINIDAE GOBILDAE WARMANTIDAE and SALMOVIDAE have been found infected.

On consumption of the infested raw fish man or the other mammalian host becomes infected. In the stomach the cysts are digested out of the flesh and the outer capsule disintegrates. On passing into the duodeniam the invigorated adolescaria breaks out of the cyst capsule and becomes attached to the duodenial wall. It next imprates to the opening of the common duct continuing its course to the bihary duct and eventually to the bihary capillaries entering more particularly those of the left lobe.

of the liver due to the fact that the path of migration into this lobe is more direct. Kobayashi (1938) has shown that in cats the young flukes reach the bile ducts 15 hours after ingestion of infected fish and require 26 days to reach maturity.

Pathogenicity and Pathology—Hoepph (1933) has examined specimens of the liver from autops) of 6 Chinese who for the greater part had met a more or less sudden death which was in no case apparently due to Clinor chis strengths infection. With the exception of one case the infection was always light or moderate. In all the cases the larger bie duets showed dilatation thickening of the wall proliferation of the biliary epithelium and in some instances designamation and new formation of bile capillates with crypt formation in the bile duets. Only a cases of liver cirrhosis were found, one of Livennec's type, the other a portful cirrhosis corresponding to the 13 pe of cirrhosis parasitaria described by previous authors and probably due to Clinoreths infection.

Increase of persportal tissue in varying degree was observed as was infiltration with ecosmophils. Fatty changes of the liver cells frequently connected with atrophy of



(Jefferys and Maxwell)

the lawer cells in the center of lobules was found in about one three of the cases I is 5 cases the central veins were surrounded by newly formed fibrous tissue and in 4 cases there occurred a thickening of the intima in the wall of small acteries and hyaliciation of the intima. The residence of the short of the control
The extent to which the liver is damaged depends upon the number of parasites present and whether there has been continuous reinfection over a period of years also the length of time the infection has existed in severe cases many thousands of parasites have been found and general exchlosis of the liver has occurred. Sambue and Bauyean reported the finding of 21 000 parasites at one autopsy. In some instances the parasites have been found oxcluding the blairy dusts and they have even been found ox the paracratic dusts and duodenim. Hospih reports that in some instances it has produced excraomatious lesions.

Infection of the pancreas is not by any means rare — katsurada found it in it 8 per cent of cases of infection — Galliard (1938) has reported a cases both of which complained of acute abdominal pain oedema, and one of diarrhoea and the other of jaundine — General asthema progressed and the direct — General asthema progressed and the pancreas — Dilatation of the ducts atrophy of the gland tissue, proliferation of the cpithelium and inflammatory reactions with local cosmophila were noted.

Uyeno (1934) has emphasized the sathological changes in the kidney which occur in experimentally infected rabbits. He believes these changes are due partly to the metabolic products of the parasite which are enrollating in the blood and partly to interended the metabolic products originating from the pathological changes in the infected livet. Gineal Manifestations—"Lany cases of Glose clus success articision of mild type pursent in unfavorable symptoms. Thus Shattock found that none of the cases persent in unfavorable symptoms. Thus Shattock found that none of the cases observed at the immigration station in Boston and subsequently in the hospital showed any gain of discusses other than a sight desimpship. Thus while pretty constant might have been due to the contributing presence of other intestinal parasites which were found 1 all the cases of clonorchasts observed. When the selection is severe the liver may eventually become other ed and finally schemic and there may be chronic diarrhoea also majastra and general cackerin may uppervise which may result stailly

Inouge has particularly studied the disease clausally in Japan. He recognizes () is a mild type without appreciable symptoms (2) a stage of severe singletion attended by distribors usedems and hypertrophy of the liver and ()) a severe type with symptoms of the second stage but agrays acted by newberment of the hepsipoporal circulation distribution of the second stage of the second stage of the second stage of the second vite has recorded in moderate infections sedigestion epizastine distress and might blidness as a lower smallestation.

Diagios s is made by the d sco ery of the characteristic eggs in the faeces or in bile

or fluid obtained through the duodenal tube

Prophylans -- Infection may be prevented by the thorough cooks g of all fresh water fish intended for consumption Thorough cooking is essent all for protection

as the cysts on survive heating to 50-70 C for 15 minutes.

In such countries as South Chain, and Indo Chain where fish are killed in the presence of the customer and eaten with condimenta in a raw state dissemination of information regarding the diagency of consuming raw sigh and educational efforts to convey such information regarding the diagency of consuming raw sigh and educational efforts to the convey such information is bould especially be made to the public in general and through the technols. In such areast the dabliton of ammonium sublakts of fresh next soil of the child of the consumer sublakts of fresh next soil.

should be employed as a dus necture agent. Typer (1933) emph tures that whereas Opt the old a may occur frequently in cats in two diff cent countries it will be found frequently in human beings in the one in which uncooked did forms an import note april of the det. Where this custom does not prevail it is confined to animals. Animals and men harboring the parasite isould be prevented from foulth mater whether it a use off ordening no that no or agrecultural for the confined to animals.

purposes Treatment has been reported as more or less us astufisctory. Intravenous unjections of antimony compounds have been reported as successful as some cases. Chandler states that in the hands of other such restrement has fulled. Chopse (1930) states that injections of meltly (whole crystal violet and Vileblee sulphate have been tred and found to be mellecture. He however mentions that intravenous injections of and found to be mellecture.

per crut solution of gentian wolet are said: be very effective. Twenty subscream treters are greated for the first dose followed by pocubo centimeters of spike large treters are greated to the first dose followed by pocubo centimeters of spike large treters recommend gent it wolet adm nettered orally in restruct catalotts to objust 3 times daily before meanls for 1 month and says that it is donorthical in growded the dye can reach the worm after it has reached the liver. Kama 1917 states the the oral administration of the sides of the first the proposed to the does administration of the sides of the first the proposed to the does administrated and the intensity of the infect in 1 lie early cases it is usually curative but in later cases while it will reduce the number of hormore present it probably will not bring about a compilete.

Cute Otto and T chan ha e recommended the intravenous aspection of gold salts. In Corea continuous non surpical bale drainage by means of the duodenal tube has been employed for getting not of some material and sometimes by the slarge numbers of the eggs re removed. It is somet mea necessary to cucanaue the throat to preven refler wen ture.

Opsthorthis felineus (Risott 1884) is normally a parasite in the hile and pancrea i c pa sages I cats does and pags. The for wolverine and seal have also been found infected. The first human case was reported from Tomak Sibersa. It has been subsequently reported in man particularly in Sheria and e stem Germany. India J pan French Indo China and the Phil pipmes.

The fluke is about p-ix mm long and s-y mm broad. It is innert chaped rounded posternely and attenuated antennelty. The testes are two lobed and not dendrint. The over are yellowish brown with an operculam which first note the thickened mm of the shell proper. At the posterior card the shell there is usually a minute tuberculit inchaning. They measure about 30 by 12m. The hatching of the eggs does not occur in the water but only after injection by certain smalls. Billyma inducible has been reported as the first intermediate host in which first generation, sponcysis and reclaim develop. Various fresh water fish (Jain Cyprinis Borbis etc.) may serve as section intermediate hosts. Vogel (1934) has Jound the small bot in Esist vice a stored intermediate hosts.

Prussia to be B leach: and the principal fish host the tench (Tence fines) Symptomatology and Pathology - The symptoms depend upon the seventy of the infection and its duration. In mild cases of infection there may be no unfavorable symptoms and no serious injury done to the liver. In severe infections enlargement of the liver with jaundice has been frequently reported. Cholecystitis and later on formation of bile stones may occur in which the ova serve as nuclei. Inflammatory reactions with deposition of fibrous tissue later may occur around the bile ducts and about the portal vessels and between the henatic cells. Plotnikov (1010) has studied the symptoms in 101 cases. He found chrome inflammation of the call bladder and bile ducts leading to circhosis of the liver and chronic pancreatitis as common Zer chantvov (1939) in a study of the blood of 147 cases in Tobolsk found that in \$1 per There was little change in the white cells except a marked cent there was annemia increase in the cosmophils. The chinical picture on the whole resembles that of Cloud this sinensis infection. The diagnosis prognosis and treatment are similar. However Szidat and Wigand (1934) state that gentian violet and Foundin have not been found to be effective for treatment

Since reservoir bosts exist both in animals as well as man and their exercts may polute the nater supply the saintary disposal of human facers alone will not prevent the spread of the infection. Human infection however may be avoided in endemic

regions by eating only well cooked fish

regions by eating only well conced has Another species of liver fluide of partheries enterins (Porsier 1886) is distinguished especially from O falinear by the greater proximity of the overy and testes the aggregation of its vicilitaria into a few large clusters of granular material and the distinct size and shape of its eggs 26 by 12. This parasite has been reported as present in the facers in about 20 erg cent of the natives in the Laos country in northern Stam.

Opisthorchia noverca (Braun 1902) a parasite of the dog has been found in the bide ducts of 2 matives in Calcutta. It is fance shaped and covered with spines. It measures to by 2 5 mm and the eggs 34 by 21 m are larger and hence readily dis

tinguishable from those of the preceding species

Chandler (1969) points out that the groun Angh merus distinguished from Optitherists by having a post-warrand dvission of the yolk glands contains a species A printedfriness found in catt and copotes as central United States. It would probably infect man of opportunity were offered. The quest Marches contains falses which are shorter and broader than Opisito that Cameron (1953) has reported the very common occurrence of a species of the genus it compared to many hands of the sensing animals over a large part of Cameda. It causes considerable most bearing animals and occurrence of the genus it considerable most proposed and the control of the ground of the considerable most proposed and the control of the ground of the considerable most proposed and the control of the ground o

The pathogenic effects treatment and epidemiology of these infections do not differ in any way so far as known from those of Cl norch s

FASCIORIASIS

Fasciola hepatica (Linnaeus 1758) givang rise to the disease Fascioliant Syn Dail ma hepol cum (Linnaeus 1736) Fasc dia cal formica (Sinitain 1933) Fasc dia helli (Sinitain 1933) It was the first trematode to be described by de Brie 1379 and it was the first digenetic trematode whose complete life cycle was chicalated (Leuckart 1883 Thomas 1883)

Solver sphical Distribution — Fast: Is beyonce in cornally parasition sheep and other historicous namasis in what it causes the destructive disasts where it is the historicous animals in what it causes the destructive disasts where it is find fact a cosmopolitan and particularly prevals in sheep raising countries. In the United States it is enforcing in catesower areas in the south and west is well as in some of the north central states. Practically all herbavorous and a number of omnovorous namical including man have been found mixted of the writer (1930) found it in the buffalo Babalas edger in the Iturt forest Belg an Congo Over 100 authentic human cases have been reported According for Eurost (1930) in Verencela Argentina Puerto Rico Cuba Syria China Soviet Russa France Italy Conica Hungary Rogunsian Salones the Darfardelle Algeria and French Somalitade.

Metphology—Fassacia kepst or a fleshy fluke measuring from a sporm in neight by sort mum in with it is relatively flat and leaf like along the margins. Both the intestine and testes are characteristically branched. The two testes is one shared the other in the second and third quarters of the body. The diameter of the oral suckers is min of the acetabulum is 0 mm. The eggs are ovoidal and operculated warranns rate by 80 feet. They are laid in the immanute stage in the proximal bilanys warranns rate by 80 feet. They are laid in the immanute stage in the proximal bilanys.

passage of the host and are evacuated in the facces

Life History—The own matures awater in owis days at the appropriate temperature of away G. Matter hatching the escaping marsacks which are eye spotted indict various analis a few hours after hetching. Such a sits which serve as the intermediate heat include species of Lymosoc dispersion of Lymosoc Personner. Prest colled Ball and and Ampalls a In these smalls the parasite develops into first generation approxyta their redies daughter redies and finally certains. Mature certains after escaping from the smalls may swim in the water and keep motile for solons as Such as a such as the smalls may swim in the water and keep motile for solons as Such as

The cercariae then discard their tails and encyst as minute white spherules on different forms of aquatic vegetation and on the bark of shrubs or free in the water. These cysts are viable for a long period when most but succumb quickly when dry

Man and other mammals consuming such vegetation or diriking at containmated sites may contract the infection. The metacercanies except in the duodenum and migrate through the intestinal wall into the body cauty. They then pass through the capsule of the liver or via the portal vein and through the liver parenchyma to the binary passages where they grow to maturity as demonstrated by Simitisn 1915 and Sizuki 1931. It seems probable that the migrating larvae may also get into the mesentient evens or lymphatics and eventually be carried to the liver or in some cases more directly to the right heart from where they may be carried to unusual localities. Thus Diss (1927) found the parasite in a tumor beneath the mammary gland in a patient 50 years of age. It was formerly thought that the metacercaries might enter the bilary tract directly through the ampulla of Vater. This however has not been confirmed by recent investigations.

Pathology —The symptoms in man are frequently maid. When the infections are very heavy as in skeep the passage I the parasites through the hver parenchym may give rise to mechanical and tour cractions which may result in necross thickening and cystic distation of the bile ducts and eventually to portal circhos s with eachems and amenua. In severe infections it is not usualt to find small abscess pockets

1444 FASCIOTIOSIS

In other instances adenomate of the bihary epithelium may form and areas of cosmo-philic and leucocytic infiltration may be found in the liver

Symptoms -The incubation period may require 3-4 months from the time of infection Brumpt and Lavier (1939) report that the early symptoms of infection before the ova appear and while the larval fluke is establishing itself in the liver may consist of fever and a very painful liver sometimes with evidences of pulmonary disturbances at the base of the right lung together with symptoms of toxaemia These symptoms often disappear after the finkes have matured and become located in the bile passages Inflammation of the bile ducts occurs later and the eggs are then present in the faeces. Kours who studied 35 cases in Cuba reported serious symptoms in many relating to the liver gall bladder alimentary canal, and nervous system. In Syria an infection known as

halzoun (on account of the symptoms of suffocation) has been reported following the eating of raw liver of goats and sheep at sacrificial cere monies The parasites attach themselves to the membrane of the throat and mouth and in some instances wander into the larynx and give rise to unitation congestion ringing of the ears labored breathing and at times alarming symptoms probably of anaphylactic nature

Flury and Leeb bave demonstrated that the toxacmia which occurs in some instances is due to the by products of the norms and that these may result in the production of a

condition of cacheria aquesa (Griesinger a disease)

In other cases of human infection bepatic cohe general abdominal rigidity with pata on pressure intermittent diarehoea urticana with leucocytosis and cosmophilia and pregular fever have been reported. At least several cases have been operated upon for cholecystitis Croste reported a case in France in which the patient auffered from ancrexia digestive disturbances and diarrhoea and an incision was made over the liver and into the bile duct for biliary obstruction. The parantes were demonstrated in material from the duct. Leveret and Champagne refer to 3 cases in Algeria, in one of which the parasites were found and the diagnosis made at an operation on the bile duct In isolated instances the parasites bave been found in unusual locations includ ing blood vessels lungs subcutaneous tissues ventricles of the brain and other organs

Epidemiology -- Human infection may result from the ingestion of the encysted metacercarase attached to green vegetables Chandler (1040) notes that watercress is one of the commonest means of infection but domestic grown watercress is seldom exposed to cercariae of Fasciola The eating of infected raw liver of goats and sheep has proved to be another source of infection Especially sheep but also goats may play

an important part in the dissemination of the infection in nature Diagnosis - Diagnosis is made by the discovery of the ova in the patient's atools

or from material obtained from the dandenum or biliary tract Precipitation and complement fixation tests have been recommended as aids to diagnosis but they have not apparently been extensively employed. In connection with the finding of ove in the facces in patients who have been eating raw liver, as for example in the treatment of anaemia it should be noted that false fasciolians may occur through simple passage of the eggs through the intestinal tract without resulting infection. Such a condition may be differentiated from actual infection by withdrawing the liver diet for a few days and if the ova continue to be passed the infection is probably genuine

Prognosis - Prognosis depends especially upon the seventy of the infection. It is usually good or fair in mild infections, but grave in heavy ones and when serious involve

ment of the hver has occurred

Treatment.-According to Koun (1932) emetin hadrochloride is valuable He has administered the drug intramuscularly ong gm daily for 17-18 days Monnig (1934) Kourt (1944) in studies in Havana again confirms the value of this treatment

has found carbon tetrachloride valuable for removal of the adult parasites but it is Faust reports that tetrachlorethylene is not specific Montgomery and others in treating the infection in sheep have demonstrated that electesin of male fern destroys the mature parasites in the bile tracts but doe not kill or injure the immature worms pas ing through the liver parenchyma. Liviere (934) has advocated intravenous injections of a per cent magdala rose dye f r human cases

Prophylaxis - Pharyngeal fasciol asis may be avoided by the thorough cooking of the infected liver and by avoiding cating raw liver. Also in infected endemic regions watercress should be avoided Brumpt and Lavier (1939) who collected 89 cases of human infection believe that man especially gets his infection from eating raw water cress growing in places to which sheep have access. However, this vegetable may be safe for consumption in districts which are chemically manured and from which sheep are excluded

Danger of human infection with the parasite will obviously he lessened by detection and eradication of the reservoir bosts especially infested sheep and goats. Animals should he treated by chemotherapeusis and an attempt should he made to destroy the melluscan hosts either by the use of a so oog solution of copper sulphate or through drainage of pastures

A closely related but larger parasite F giganties which is more lanceolate and has larger eggs is a common boyane parasite in Africa and in parts of the Far East. Three

cases of human inject on have been reported

D crocoelium dendriticum (Rudolphi 8 8) (Fasciola dendriticum Ludolph 1870 D tenceoletum Designdin 1845) also a common parasite of the blary passages of cattle and sheep has been reported in man occa ionally Genu e hum n infections are apparently relatively few in Europe Egypt north ra Africa the Belgian Congo Java and China However extensive paras tic surveys in Russia Syria and Shansi Province China have demonstrated a number of cases in which the ova of the parasite were found in the stools Many cases have been reported recently from Tashkent in Turkestan However in the majority of the c ses in some localities the presence of the ova in the stool was accounted for by the individuals having eaten more or less raw infected it er of sheep or goats and sn which the paras to had not definitely infected tha individual and invaded the tissues It is regarded by some as usually only an accidental infestation of man Thus Nitzulesco (1939) found ova of Dc occel m d d t cum present in 3.74 per cent of a thousand examinations. He thinks they were eggs awal lowed in food and they were not found when a second examination could he made. In other cases Taust states they were undoubtedly genuine infections as determined by controlled diets

When the parasites invade the biliary passages in man and animals similar disturbances to those produced by Fasciola may occur The liver may show small whitish areas several millimeters in diameter and occasionally small infarctions in which the trematodes are encountered histological study the bile ducts are distended in size and contain sections of the trematodes with ova The epithelium lining the ducts may be compressed and degenerated or destroyed and there may be infiltrations of round cells and leucocytes about the walls. Often there is an increase in the connective tissues surrounding the bile ducts the cirrhosis gradually extending outward Frequently there is more or less necrosis about the parasites and extensive infiltration of the tissue with polymorphonuclear and endothelial leucocytes In man symptoms of diarrheoea dyspepsia vomiting and enlarged liver have been observed

The fluke is lancet-sh ped flat and from 5-12 mm long and 1 5-2 5 b oad and is characterized by having slightly lobed testes anterior to the ovary just behind the ventral sucker The o a have a thick shell and are golden brown in color They are 1444 **FASCIOLIOSIS**

In other instances adenomata of the biliary epithelium may form and areas of cosmo-philic and leucocytic infiltration may be found in the liver

Symptoms —The incubation period may require 3-4 months from the time of infection Brumpt and Lavier (1939) report that the early symptoms of infection before the ova appear and while the larval fluke is establishing itself in the liver, may consist of lever and a very painful liver sometimes with evidences of pulmonary disturbances at the base of the right lung together with symptoms of toxacima. These symptoms often disappear after the flukes have matured and become located in the bile passages Inflammation of the bile ducts occurs later and the eggs are then present in the facees Kouri who studied 35 cases in Cuba reported serious symptoms in many relating to the liver, gall bladder alimentary canal, and nervous system. In Syria an infection known as

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Prognosis —Prognosis depends e pecially upon the sevent; of the infection It is usually good or fat in mild infections but grave in heavy ones and when serious involve

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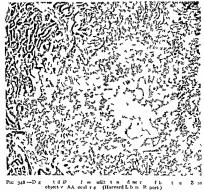
Treatment.-According to Kourt (1932) emetin hydrochloride is valuable. He has adm at tered the drug inframuscularly o 03 gm daily for 17-18 days Monnig (1954) Kourt (1944) in studies in Havana again confirms the value of this treatment

Chandler reports that another fluke of the same family Euryl ema pancreaticum lives in the pancreatic ducts of p.g.s and in the libitary ducts of cattle water buffaloes and camels in China Its the cker body and large oral sucker suffice to distinguish it from Distracted from A few human cases have been recorded from South China

Treatment for these infections should be the same as outlined for Fasciala I epatica

INTESTINAL PLUKES

Fasciolopsis buski (Lankaster 1557) Syn (Distomum crassum Busk 1859) normally a parasite of the pig occurs in man quite fre



object v AA ocul r 4 (Harvard L b n R port)

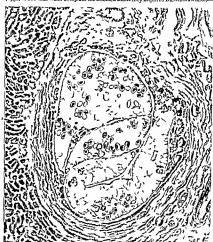
quently in India China and Cochin China and other parts of the

Orient

It is the largest trematode found in man being a flat raiber fleshy fluke measuring about 40 mm to 70 mm long and 2 mm broad. Its thick brown in color and his avery large acetabulum three to four times the save of the oral sucker and located almost adoptent to it. The branched owny madshelf had then the center with the dicholor only branched tester posterior. The grainfed stress is nativor to the testes. This save that the save is the save and the save for the disconnect of the correction of the save and the save and the save for the disconnect of the correction of the save and the save and the save for the disconnect of the disconnect of the save and the save and the save and the save and the save for the disconnect of the save and the

1446 PASCIOLIASIS

distinctly operculated measuring 38-45µ long by 22-30µ. When passed in the faces they are fully embryonated. They are quite resistant to desirction and do not latter in water. After ingestion by appropriate land smalls species of Zehran Hillichla Torguilla and probably other species creatare are eventually produced. Camero (1931) found that when sheep at the infected smalls they acquired Decreotlymmington (1931) found that when sheep at the infected smalls they acquired Decreotlymmington.



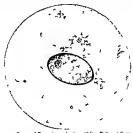
Fir 347—Paras tes within di tended bile d ets comp ng and de troy g the spithel um. The duct enclosed parts illy in fib ous ti us. Drawing of sect on fliver of monkey illu trating infection with D croco lumi colobu cola. (Harvard L bena Rep rt.)

However Brown (1933) believes that restard infection involves a second intermediate host probably a dupterous farrar the mage of which is eather accidentally by the defautive host. Academic (1938) has found that the crearans may invade the respiratory chamber of the mail where several handred may become enclosed in Minny (55 s. These cysts or sline balls are dropped by the small on most vegetation and after their mages to by a suitable host the creatrans reach the liver by the portal blood system and are unusual in not losing their tails or stilets until they have reached their final destination.

distributed throughout the yolk cells while those in F hepatica are clumped around the yolk cell nucles. The eggs are operculate and immature when deposited

yolk (cd macies I he eggs are opercurate and immanute when depoisons. Treatment—N-thCoy and Chi. (1937) have employed hespitesor timol crystoids (caprokol) in doses of a 4 gm. for children it to 7 years of age up to 1 gm. for those 13 years or over 1 g ozes were thus treated and 5 gp tere cent were cured. If a 5 gp creat of the cases the egg output was very greatly reduced. It is emphasized that great care must be used to prevent fialt lies due to therapeatic agents employed especially from cardiacfulure. Barlo in easher years recommended among other dures beta amphithol and carhoe tetrachloride. He thinks caprokol 1 probably superior for treatment.

Prophylans — Vegetables or salads should be immersed in bo ing water for a few seconds before be ng eaten Copper sulphate 1 50-00 may be employed for the destruction of the intermediate hosts in the infected areas Stenlination of the facecs



Tio 350 -Ovum of Fasc 1 ps s b sh (Aft B il nd Sutton)

should be carried out whenever practicable. The disease is especially spread in China by means of human night soil for fertilization

HETEROPHYLASIS

Heterophyes heterophyes (Siebold 8 a) (Syn Cotylogonimus h t ophye Luhe Soo) This minute fluke w a first di covered in the intest es by Bilharz in 1851 at an aut psy of an individual in Cairo The paras te is common in Egypt in the N l delta It has also been found in Palesti e and in the Far E st especially in central and south China Japan and K ea Formosa and the Philippine Islands Normally it as par a te of dogs and cuts and the for but also occurs frequently : in n The parasite is very small measuring 7 m in le gth by 0 3 to 0 4 mm in breadth. It can be recognized by the large p omnent acetabulum The oral sucker is much am ile \ ry charac tenstic I the genus is the large sucker I ke genit I pore 1 st b low and to one side of the acetabulum and surrounded by a collar of spines. The elliptical testes I e at the extreme posterior end The cuticle has scale like spines. The eggs are minute oper culate light brown 30- 7 have a thick shell nd c tan a developed miracid: m when deposited They hatch only after a gestion by the appropriate f esh water snail khalil has report d that the snail Ps mell's consea serves as the first intermediate host in Egypt. Man acqui es the infects n by eating raw mullet as Mugil cephal ; the sec dintermediate host and other species in the Far East

(various species of Planorbu and Sepaentina) The cereaniae require no second intermediate both but encyst on a various fresh water plants especially the water chestian translations to the encyst on electron to man if eaten from Thee are the ender arise they are frequently fertilized by reflection to man if eaten from Thee are some areas where they are frequently fertilized by reflecting the resh night soil into the water. Sain abound in these warm stagnant pools and the resh night soil into the water. Sain abound in these warm stagnant pools and the plants. The sainly become nicted by maracidia from the ovar and the escapping cerearine subsequently encyst on the plants must continue to the second of the plants. The sainly become nicted by the plants of the plant

Symptoms —The parasite inhabits the small intestine and if numer ous may cause durthoea, anaemia and even annasire and falat cachesta. While the parasites are usually attached to the duodenal or jejunal wall they are sometimes present in the mucosa of the pylorus. In other instances they have been found attached to the wall of the large intestine At the point of attachment a local center of inflammation may occur which



Fig 349-F solopses & sk Cl 4 d in glycerso (From Jeff 3s and Ma well)

usually later results in ulceration. In some instances the capillaries become eroded and haemorrhage results. Abscesses may also develop in the mucosa. The first symptoms are usually a toxic diarrhoea some times accompanied by pain in the abdomen. In mild infection these may be the only notable symptoms. Severe infections, however may be accompanied by towe symptoms and the presence of areas of oedema especially about the face abdominal wall and lower extremities. Assites is common and often accompanied by generalized abdominal pain. In advanced stages of the disease anorean nausea and vomiting octural contents of the content of

Diagnosis —The diagnosis may be made by the discovery of the eggs in the faces. It is practically impossible to distinguish the ova of Fascoloping from those of Fascolophethe theorem. Simple discover Kampaika reports that the yolk granules in F bushs are equally

latter is not surrounded by a collar of spines The ova are about 33 by 204 They are very difficult to distinguish from those of H & t rephyer The intermediate hosts are (1) snails of the genus Melania and (2) the fresh water fish Pl ctoglossus altivel s Odo i buits obscuris Salmo pe y and Leucescus hakuenses all of which are valuable food fishes The cercarae often encyst under the scales

ECRINOSTOMIASIS

Echinostoma ilocanum (Garrison 1908) (Syn Euparyphium iloca um Fascioletto ilocana) Gaisson fi st d scovered the ova of this parasite in natives in Manila in 1907 and later recovered 21 adult worms following administration of oleores n of male fern Tubangus and Pasco found that the Norway rat may serve as a reserve r of the infection and that the disease was probably restricted to the Ilocano tribe inhabitants of the Flocus Sur a district in the northwestern part of the Island of Luzon P I They demonstrated the life h story of the parasite Chen (1934) found about 13 per cent of the native dogs in Canton infected with this parasite Brug and Tesch (1937) next reported it from the Paloe district of the Celebes Sandground and Bonne (1010 1030) ha e found it in Batavia

Etiology -The parasite which lives attached to the wall of the small intestine is reddish gray in appearance and is a small species measuring from 2 g to 6 g mm in length a dit to 1 5 mm in breadth. At the anterior end it is provided with a circumoral di k and has a croi n of g spines and a spiny body. The oral sucker lies in the center of the oral disk the ventral sucker in the anterior part of the body proper There are a mas ave deeply lobed testes one behind the other in the third quarter of the body and the transversely o ordal ovary is situated in front of the anterior testes The straw colored opercul ted eggs measure 81-116 by 53-60 and are immature

when passed in the facces but mature in water in 6- g days

The same or a closely related species E malayonum a larger fluke with 42 collar spines has been found to infect a high percentage of certain of the tribes of the Sino Tibetan frontier and of the Tamils of the Malay States Sandground and Bonne (1940) have found a high mendence of human infection with a species they named E I doe s s which has 37 collar spines and closely resembles the species E rev lutum of ducks and other aquatic birds It was encountered around the shores of Lake Lindoe in the Celebes. It is apparently primarily a human parasite for natural infections were not found in either rate or water birds

L fe II sto y - The ova of E slocanum batch in water and the m racidia penetrate the viscera of a snail in Luzon Prio is onica coording to Tubangui and Pasco They fed this snail as well as there as Is that harbored the metacercanae to many laboratory white rats and monkeys and a cat all of which animals hecame infected with n the

course of a fe v weeks with the adult worms According to Rac in India E walay num invades the small Lymnaea luteria as the first intermedi to host while a fish th Barbel (Bo bus strem) as well as the

anail may serve as the second inte mediate host

Sandground working in Batavia has fe dthe developmental st ges (metaceicaria) m present in a large proportion of the Planorbid snails. Amous convers us ul is Ifutt and later also in Lymnaca rub g osa brevis Mous 1 ip u y Phil a d P la com a Gray the spec es of snails being identified by Bequaeit (1940) Laboratory raised white rata were experimentally fed with the abo e named 1 fected sn ils and became infected with E ilo a r A transient human infection was obtained by the i ge tion of metacercars e from the smal A sur

With F Ind six in a small plan rbid small Ansing so a ino cum larval develop ment was found in a trust infections. The met cercariae were found in several pulm nat an ils i po us par cus rudap ll s und al o in the mus el Corbicula lindo

s s Boll These mussels form a regular part of the diet of natives

Symptoms -Bonne (1940) describes the symptoms in the main as diarrhoea and slight pain in the bowels. In experimental human infecSymptomatology and Pathology—The parasites inhabit the deum, often in large numbers, where they become attached to the wall of the small intestines. At times they are deeply lodged in the crypts. When present in large numbers, they may produce a mild irritation accompanied by colicky pain and mueus diarrhoea. A hall (1934) has noted that there may be a superficial necrosis of the mucosa and an excess of mucus in the stools.

Africa and his associates deLeon and Garcia (1040) have emphasized the visceral complications that may occur in connection with intestinal heterophysiass of man. They have shown that several other species of heterophysis which are apparently not well adapted to man as a host may live in the walls of the intesting and that the owa of these worms may pass through the intestinal wall into the mesentieri lymphatics and become distributed in different parts of the human hody where they may cause serious injury. Most frequently lesions were found in the heart where the eggs were frequently deposited in large numbers in the cardiac valves and myocardium. Here they give ruse to symptoms of acute dilatation and a dropsical condition and 3 symptoms similar to cardiac valves between The cases often resulted fatally.

In 297 netrophies in Manila intestinal beterophyid infection was found in 24 and nearly half of these had visceral complications usually of the heart. In 23 cavilar symptoms were observed in the and the patients were believed to have died from heart failure. The eggs were also found in the brain and spinal cord and have been associated with gross netrous symptoms and with fatal cerebral hemorphies. Distribuce met a very frequent symptom of severe infection. The parasites were found twice in the liver once in the lungs and once in the aplece.

The species of heterophids causing these coordinons are classified in a number of different genera. Heterophysiss is primarily an intestinal infection but in Manila about 44 per cent of the intestinal infections showed visical complications. Afficie emphasizes that the le ions due to the ova of this parasite partake of the nature of a typical reticulo endothelial prohiberation with very little or none at all of the other.

cellular elements found in other helminth infections

Diagnosis -The diagnosis may be made from the discovery of the eggs in the faces

(see above) They somewhat resemble those of Clonorchis sinensis

The prognosss depends upon the eatent and nature of the visceral invasions with the ova. When the owa are deposited in the heart cardiac failure and death may occur for treatment tetrachorethylene as prescribed for bookworm infection is recom-

mended

Premitton depends upon avoiding eating raw or partially cooked or salted mullet or other infected fresh or salt water fish in which the cercarine may develop

Metagonimus yokopawi Katainada 1922 (Syn Lentieme preisum Kobayakin 1971). This wortow and first detected by Katainada is as access of Herinophysi. It is probably one of the most common Heterophyadae in the Far East in Japan Korte Formosa and the Mantine Provances of Sovient Russa the mosthern provinces of Sovient and the Baltan States. It has also been reported from man in Spain. It is found in cats dogs and pits a well-as man. It is found in cats dogs and pits a well-as man. It is usually causes very few symptoms. In several tections symptoms and viscerial lessons simulate to those produced by Heterophysis occur However Africa (1927) states that once the worms invade the mucosa they remain there until the yell. Failure of the host to encapsulate the parantes may account for the infiltration of the eggs into the circulation and visceria.

It is a minute fluke x to 2 mm long and 0 6 mm wide inhabiting the duodenum.

The acctabulum is displaced to one side together with the common geoist pore. The

dussemanted. The parasite has also been reported from man in Cochin Clinia and from Indian immigrants to British Cuiana. It has been suggested that the pag is a common reservoir host in India and Assam while in the Malay States the Napu mouse deer Tragulus maps. In a also been found miceted. It has also been found in field rats in Java.

The parasite lives in the caecum and large intestine where it may give rise to some inflammatory change and may cause diarrhoes. The adult worm usually measures from ahout 5-7 mm in length Some specimens occasionally measure as much as 10 mm in length by 4-6 mm in b eadth. The adult worms have an orange red appear ance caused hy a fine net work of red capillary like structu es in the cuticle against a flesh colored background. The body is divided into 2 parts. It consists of a posterior co cave di k like portion from which proceeds a teat like projection bearing an oral sucker The acetabulum 1 in the posters r margin of the disk. The ovary is behild the testes SI ghtly behind the middle of the anterior portion in the median line is the prominent genital to e which characterizes the genus. The ovoidal operculated o a measure 150 by 7 µ They are rhomboidal in shape tapering rapidly towards each Miracidia develop after the eggs have escaped from their host. However, nothing more of the life history is known. By analogy with other amphistomes there is probably little doubt that the cercariae encyst on various forms of aquatic vegeta t on and that the life cycle is similar to Fasciolidae. The life cycle in the related species Gastrodiscus a gypt cus of the intesti e of the wart hog is believed to utilize the snail Cleopaira bul mordes as an intermed ate host

the state telepara out moves a sain terminance around. Epidemiology—Although the pig is a common reservoir host in some localit es and has been reported by some as a common reservoir of human infection. Buckley found that in some places in Bengal and Assam where the heaviest human infections occur pigs were rare and could hardly have served as a re error for human infection. It is presumed that as 11 the ease of Fave Indee man may contract the infection for

the ingestion of uncooked forms of infected wat r eget tion

Treatment—Manson Babs states that the parasites can eastly be explied from the intestinal tract by thymol and cabon tetrachlarde. Chandler however points out that the parasites often not explicit premove day anthelmant es but sometimes treatment with high soap water enemas give good results. Buckley by means of soap water enemas obtained nearly a thousand parasites from an 8 years of the manson of the parasite
Watsonus watsom (Cosyngham 100) (Syn 4myhrisos m 10) Inthonolyother amphiatomes of n found in man and there has been reported but a single case from the N gen in shore of Lake Chad The patient suffered from a severe watery duarhoes which resulted fatally. At attopsy the parasites were roce cred from the intestinal wall some attached to the doodenum and pigninum. Others were free in the I meen of the large hovel. The pa is tear are redid hydrom in olor and thick and pear shaped he ng sightly concave ventrally with a 1 andiscent gelationus appeara ce. They measure about 5 a o min long by 4 mm sude. The posterior satisfies this a diameter of about a mm. It is provided with a lateral posches. The eggs are oxidial amount to 10 about in mm. It is provided with a lateral posches. The eggs are oxidial amount of about a mm. The original of the control of the

Infection m n is probably contracted as in the case of other amphistomes by ingesting vegetation on which the metacercanae has e encysted he ce avoid nee of eating uncooked vegetables grown in water which has been contain nated by the ova of the worms would potect against a fection

Paragonimiasis (Endemic Haemoptysis)

The disease is due to infection with the trematode Paragonimus uestermans (P ringeri) and is characterized by pulmonary symptoms and

tions the diarrhoea disappeared a few weeks after the infection became established. The cosmophila was increased to as high as 38 per cent 5 weeks after the origin of the infection and came down to normal a few weeks later. In the meantime a large number of the parasites present were expelled. The human infections were not transient, the worms bung still present and producing out a months after the experimental infection. The infections were severe as was shown by treatment with tetrachlor ethylene. As many as a60 flules were brought away in the first stool after treatment.

Epidemiology -- Human infection with Echinosiomes occurs from the fact that the cercariae after escaping from some small Planorbid snail which serves as the first inter mediate host penetrate into and encyst in various other molluses which are locally In Luzon the parasite encysts in the snail Pila is onica which is esten raw by the Ilocarnos The cosmopolitan parasite of dogs and goese E resoluturs is said by Chandler to infect from 3 to 6 per cent of people in parts of Formosa and to result from esting raw limpets. Sandground and Bonne in their studies in the Celebes found that practically 100 per cent of the snails were infected in the rice fields in certain localities About Lindoe in a villages they found human percentages of infection of 96 44 and 24 The mussels taken from the lake close to the heavily infected village were found carrying large numbers of Echinostome metacercariae The mussels con stitute a prominent article of the daily diet of the local population. They are exten after passing through a primitive boiling process. Such mussels on heing fed to labora tory bred rats and mice and being eaten by both Bonne and Sandground I roductd infections in which the Echinostomes were demonstrated. In rate and mice the para sites do not grow as large as they do in man

In Batavia Sandground found 22 cases of human echinostomiasis among the lunated at an asylum for the insane. The normal population flying near were not found to be infected. It was found that the consumption by the lunates of uncooked snalls took place as was directly nitnessed by Sandground.

Treatment -Sandground has treated 11 cases with 2 to 4 5 cc of tetrachlorethylene

(C.Cl) The patients passed from 13 to over 270 norms after the administration of the drug Prophylams —According to the investigations of Tubangui in the Philippines and of Sandground in Java the parasite E Mecanism is primarily one of the Yoray rate field tat. However the parasite has also been found to be common in days in Charles

field rat. However the parasite has also been found to be common in dogs it Cantow by Chen (1934). Hence all of these annuls any serve to disseminate the disease. Other species of Lehinoidomes recorded from man are Paryphotical and Exponent as pic parasite on the man axie in Assam Echinoidomes Parapiloidas and Exponent parasites of the cat and dog in Europe and the Far East which were fish as second intermediate house. A few natural and exportmental human cares those of the control of the Assam is New York. And several other species of Echinoidom as Rumania Russias and

Japan some of which encyst in todpoles: E persudue pathogenic for pigeon has be neported from man in Russa. A specie of Plegreschis has been found by Africa and Garcia at an autopsy of a native of Bocano P. I where the inhabitants ext the grubs of certain innects believed to be the second intermedate bosts of this tremstode Sandground (1930) has reported a second species from a native in Battaia and his amend the species P 10.000 among the property of the pr

in the caccum in a patient in India and subsequently redescribed by Leiper and by Ste en. The former treated the genus Gairbodisco der for it. It is a relatively common human parasite in Assam. Than Buckley (1799) found it in over 40 per cent of 221 people examined in 3 villages in Assam, where it was thought to be probably widely

pore. The testes and ovaries are branched. The ovary and therm are placed on opposite size usefue of the holy in forts of the testes. The entitleder covered with scale lite is pure. The spocus are differentiated largely on the arrangement of the spones. In P rangers, they have been described as weekly shaped at a grouped in clusters of $3\tau^{-2}$. In P west remain (the spocus observed by the writer in the Ph 1p one falands) they are scattered and P comp d x they are said to be arranged in clumps.

A study of the life cycle has demonstrated difference in both the morphology and behavior of the developmental stages between the Korean and American forms and also between the Korean and Japanese forms P bell cett which has heen found in North and South American in the pulso dog and ext and open size a rather common prastie of the mink in North American and Canada. At least o etc. so of human infection has here recorted in No th America. This believed by some para informists to represent

distinct species However Chandler (1940) thinks a final settlement of the speces of this genus is not yet possible. A selected species has been found in the tiger in the Mulay States. Recently Chen has found a form

in rats in Canton

The eggs are dark brown 90-539 in size. The shell shows a thickening opposite the opercul in which is most marked in P i pt. They are unsegmented when deposited and require about 4 weeks under lavorable could tions for the development of the markedium outside the body.

Infection of man results from consumption of unfected crashs or caysfish which serve as the second intermediate host in endemic region. The own of the parasites usually, coughed up in the sputim and expectorated or swallowed and passed in the facets are the source of unfection of the intermediate hosts. Hence human infection is often sooradic.



Fig 352-P g m gr photograph f m lly mm t re spec m n

The first intermediate host is a snail of which at s illy mm least s x species of Melania have been to d to be (P m Ty n) effective part cularly M 1 de l dot related forms. In

Venezuela where P k ll cotts is found the snail is Amp ll a a l 1 o t a These are perculated aquatic snail attached to sto es etc in ponds and streams. The cercariac after escaping from the snail into the water hore their way's to certain species of fresh

water crustaceans the second intermed ate host

The second i termedule host has crah a species of the group Polomon Elio h r or in Korea a species of craylish African in which they undergo growth and development for δ weeks or more. In the United States Chandler (1900) says Pomat op a lept serves as the molluscan host of Paliforist while probably all the species of Comba serve as the crustacean hosts (Anceel 934). In the human cases of infection of P Add out reproted in the U ted States the paterials h d catter craylish prepared by a Corroan cost. Experimental feeding of pagin as with infected crabs has hought about many costs of the craw of the craw of the cost of the cost of the craw (1900) and the cost of the craw (1900) and the craw (1900) and (1

may he for some time after escape fr m th second intermed; te host.

After the ration from their greated gives the young fluke is believed to penetrate the
intestinal will migrate through the pentoneal cavity, and burrow through the dis
plargem into the long. Here they mat e and are found often in large numbers in
functed late cavities or cysts inceed by themes which which communicate with the bronchin

by the appearance of rusty brown sputum in which the characteristic eggs of the parasite are present

GEOGRAPHICAL DISTRIBUTION AND HISTORY

Geographical Distribution.-The disease occurs in the Far East in New Guinea the Dutch East Indies Indea and in parts of China Indo China Siam and the Malay States and the Philippines Also especially in Korea Japan and Formosa where in some districts from 40 to 50 per cent of the population are infected. In Africa the disease has been encountered especially in the British Cameroons and the Belgian Congo and in South America in the Matto Grosso area of Brazil in Peru and in The species described as P kellicotts has been found in at least one human case in the United States

History -- In 1880 Baelz found the ova in the sputum of a Japanese patient with haemoptysis and in the same year Manson described the disease and found the ovain



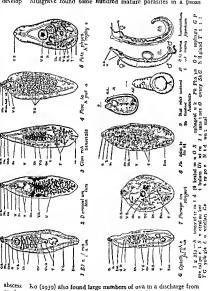
Fig 351 - Sputum of man conta n ng eggs of the lung fluke g eatly enl rg d (Alter

the sputum of a Chinese Manson's patient subsequently died and at the autopsy a fluke was found in the lungs which was the source of the eggs seen by him in the sputum However Ringer (1881) first found the mature parasite in an autopsy in 1870 which was later described by Cobbold under the name of Distonium ringers Subse quently it was recognized to be closely related to if not identical with the previously described Paragonimus westermans which Kerbert found in the lungs of two Bengal tigers which died in the Hamburg and Amsterdam zoological gardens. A relatively high incidence of Paragonimus infection is found to exist among leopards and tigers in China (Wu 1939)

Japanese investigators especially Kobayashi and Yoko, awa have contributed to the elucidation of the complete life cycle Etiology -Paragonimus tiestermans (Kerbert 1878) and P ringers (P compactus

Cohbold r880) are very closely related or identical fluxes which occur as parasites in the lungs of man They also occur in pigs dogs cats rats and various wild carnivores as the tiger wild cat panther fox wolf and the beaver The flukes are reddish brown in color and rather flesh like in appearance measuring from 8-20 mm long and 5-9 mm wide They are evoidal to shape with some flattening of the ventral surface. The oral sucker is terminal or subterminal A veotral sucker the acetabulum is con spictions and hes just anterior to the middle of the body and close to the common genital Miller and Wilbur (1944) have reported 3 cases in Mannes from the South Pacific

wall the ova may give rise to a darrhoea with the presence of ova in the stools. In the skin and subcutaneous tissue abscesses sometimes develop. Musgrave found some hundred mature parasites in a psoas



 giving rise to many of the pathological and clinical features of bronchectasis. Here they may live for at least 6 years possibly much longer. The one are of in swalload in in the spatium and may be passed in the faces. Less often the fluids inwade other tissues including the liver intestinal wall (when ove also may be found in the freezi) tester prostate lymph nodes six in mayele and brain

Pathology -On examining the lungs, small brown spots may be thickly distributed over the entire surface of the pleurs, and deeper in the lungs many small cysts of a deep red color may occur in all of which lesions the parasites are found. The flukes are also often found in burrows or tunnels the walls of which are formed of connective tissue lesions or tunnels result from hypertrophy of the bronchioles may also be formed from breaking down of the adjacent tunnel walls Musgrave in his studies in the Philippines described (1) non suppura tive areas containing eggs leading to round cell and connective tissue reaction and usually to abscess formation (2) tubercle like lesions in which the abscess might contain caseous material (3) suppurative lesions and (4) ulcerative in which the healing was only partial He also pointed out that the peculiar bluish cost like burrows of the parasite occurred in many organs and tissues besides the lungs. Such lesions are encoun tered in addition to the lungs and pleura in the intestine and peritoneum liver, mesenteric lymph glands muscles testes and brain mucosa is a common seat of infiltration and here an inflammatory reaction sometimes occurs, ending in ulceration, with the appearance of the eggs in the faeces Robertson has reported the presence of ova in the spinal cord which produced during life transverse my elitis

In the lungs in advanced cases there may be a picture of generalized of coalized acute cirrhosis with cystic dilatation of the bronchi and tubercle like abscesses. Leucocytic infiltration occurs about the para

sites and there is frequently fibrous encapsulation

Symptomatology -The case is often considered as one of chronic bronchitis on account of the occurrence of cough and morning expectors tion of a gelatinous sputum which is usually brownish or reddish also known as endemic haemoptysis for the reason that after violent exertion, or at times without mainfest reason attacks of haemopt) sis of varying degrees of severity come on The signs on percussion are usually insignificant while those on auscultation at the time of haemoptysis are The symptoms often disappear for months to again often marked resppear Bercovitz found that \ ray examination of the lungs was usually disappointing while lipoidol infiltration revealed no cavities, prob ably because the Paragonemus infection occurred particularly at the periphery of the lungs However Wang and Hsich (1937) found there were shadows of infiltration which are direct evidence of Paragonimus infection and therefore of definite diagnostic value In some instances the physical signs may suggest broncho pneumonia or pleural effusion

The course of the disease is very chronic often lasting many years.

As a rule, the patient is fairly well nounshed although recurring attacks of haemonty sis may bring on a rather marked anaemia. In the intestinal

could not be followed 4 had no recurrence of symptoms 5 months later I died of unrelated disease and 2 relapsed with much haemopty sis

Faust (1940) appears to be doubtful about cures resulting from the use of emetine He recommends removal of the patient from the endemic foct when the clinical symptoms are usually less severe after 5 or 6 years

Troplotrema salmincola (Charin 1926) are small flukes 1 mm or less in length belonging to the same family as Pa agentmus They are common parasites of fish eating mammals (dog coyote for raccoon mank and lynx) in northwestern United States and of eastern Siberia Human infect on has been reported from eastern Siberia The snail host in Oregon USA accords g to Donham Simms and Shaw (1932) is Goniabas s of offera The free swimming cercariae (from the snall) hecome attached to and later encyst primarily in the kidneys of the salmon and trout. When eaten uncooked infection occurs in the definitive bost in the small and large intestine in which the parasite becomes deeply imbedded. The parasite in itself is apparently not associated with the production of disease but it is of interest because its presence has been associated with a highly f tal disease in dogs called salmon por oning a d h s ass crates (1912) have obtained e dence that the disease is caused by a virus for which the fluke serves as a vector. The fluke he am the intest nal wall of the bost

After an incubation period of a week or more there is loss of appetite fever and sensory depression followed by oedems violent vomiting and dysentery Following the d sappearance of these symptoms the temperature may drop and death ensue within 24 hours to 48 hours Recovery from one attack confers ammunity. If the case is diagnosed with n a hours of onset from 2-6 mill grams of apomorphine by mouth is sa d to protect the animal. However the severe symptoms caused by the virus have not been described in man Strom (93) has reported that aspidium is an efficient anthelmintic for removing the worms from human cases.

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paragonimiasis the ova being found in cysts of the brain. There is some question as to whether some of the earher reports as to cerebral paragon miasis may not have been connected with infections with Japaness chistosomiasis. However, in Japan a number of cases in children with brain symptoms attributed to maintle paralysis encephalitis, meningitis or cerebral baemorrhage were subsequently found to be due to infection with Paragoniums.

Diagnosis —The diagnosis of endemic haemopty sis is readly made by finding the operculated eggs in the more or less sangumolent sputum. The sputum also usually contains altered blood corpuscles and eosinophiles. Charcot Leyden crystals are often present. The faces also should be examined. Eggs that are swallowed with the sputum may be found in the faces even in the absence of intestinal lesions. Ando basesched a Bordet Gengou complement deflection test using an extract of the adult worm as antigen as an aid to diagnosis in obscure cases of the abdominal and cerebral type.

Prophylazis — The first step in prevention is to avoid the eating of raw or partially cooked crabs or cray fish. There is also a possibility that the cysts on the gills of the crustaceans may escape into the water and on drinking this water man may become infected. Chandler has recommended the treatment of water supplies with 1 to 1,000 000 copper sull phate which will kill the molliusks. It also will kill algae, but unfortunately it also may kill the young of some species of fish. The sputtum of patients should be sterilized.

Treatment—Tartar emetic does not seem to have much effect on the fulke but there have been encouraging reports from the use of emetice. Martin has tried mercurochrome in combination with emetine. Emetine hydrochloride has been especially recommended and kobayash and Ando have reported encouraging results with this drug which is said to lessen sexual activity of the trematodes. It was injected intramuscularly inspatients in doese of 1 2 5 c. of a 2 per centroduction 4 times daily for 5 days but it must be used with great caution especially in cases where there is any invocardial trouble.

Bercoutz recommends emetine in r gr daily doses for periods of 7 days. He also reported marked improvement following lipiodol injections into the bronchi

Yokogawa (1940) has reported good results in the treatment of Faragenimus infection by prontosi. Three dogs were first treated successfully
with 2 5 per cent solution of prontosi with emetine hydrochloride which
brought about rapid and radical cure. Nine buman cases were ther
treated by intramuscular injections of prontosis 2 5 per cent to a total
of 60 to 165 cc. and with intravenous emetine hydrochloride 4 per cent
to a total of 12 to 33 5 cc. over a period of 7 to 17 days. In 6 patients the
treatment was continued until the eggs after a temporary increase in
number during the first 4 days. disappeared from the sputum. In 3 it
was stopped when the degenerative changes in the eggs became con
spicuous, but in these the eggs foally desappeared. Of the 9 patients 2

could not be followed 4 had no recurrence of symptoms 5 months later

r died of unrelated disease and 2 relapsed with much haemoptysis Faust (1040) appears to be doubtful about cures resulting from the use of emetine He recommends removal of the patient from the endemic foct when the clinical symptoms are usually less severe after 5 or 6 years

Troglotrema salmincola (Chapin 1926) are small flukes 1 mm or less in length belonging to the same family as Paragonimus They are common parasites of fish eating mammals (do covote for raccooo mask and lynx) in northwestern United States a dof eastern Siberia Human infection has been reported from eastern Siberia The snail host in Oregon USA according to Donham Simms and Shaw (1932) is Gonzabarus olic fera. The free swimming cercariae (from the snail) become attached to and later encyst primarily to the kidneys of the salmon and trout. When eaten uncooked infection occurs in the definitive host to the small and I rge intestine in which the parasite becomes deeply imbedded. The parasite in itself is apparently not associated with the product on of disease but it is of interest because its presence has been associated with a highly fatal d sease in dogs called salmon poisoning and he associates (932) have obtained evidence that the disease is caused by a virus

for which the fluke serves as a vector The fluke lives in the a test; al wall of the host After an incubation per od of a week or mo e there is loss of appetite fever and sensory depression followed by ordems violent vomiting and dysentery Following the disappearance of these symptoms the temperature may drop and death ensue within 24 hours to 48 hours Recovery from one attack coofers immunity. If the case is diagnosed within a hours of onset from 2-6 milligrams of accomproh is by mouth a s id to protect the animal However the severe symptoms caused by the rus have not been described in man Strom (1935) has reported that aspidium is an efficient anthelmintic for removing the worms from human cases

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Chapter XLIX CESTODES

INFECTIONS WITH CESTODES

Although some 5 or 30 different species of tape worm have been reported as attacking man there are only 4 adult species and 3 larval species which are at all common Of the family Direktlosofthkine and phylidobilitium lating as an adult is very common while the larval form of D manons (Sparganam menons) is much less common Of the family Tarkhinae as adults T solium T saginate and Hymen oleps none and as larvae Teens solium (Cysticcrus cellulorse) and Ethinococcus granulosus are likewise prevalent Hymenoleps diministic and Diplidium consisma are family common but all other tape worm infections are rare in man Teens significa and T solium and their larval or cystic forms are frequent in different parts of the tropics and subtropics while Hymenoleps sones is largely himsted to and Spyrajanam mensions and S proliferum are generally more common in warm countries D lating is

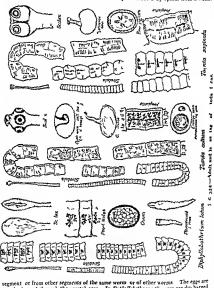
Z I pical Consider 1 st — Anast mically a tape worm may be considered as a sense of individuals united in one ribbon hise colony. It is made up of a related by minute head it a central mother segments and a sense of daughter segments (projektided) which arise from the head by a continuous process of cell pri leation. The had send the adjacent led 6 protion of the body in which segmentation a root diment (the neck.) The form the segmentation is not diment (the neck.) The form the segmentation is not diment (the neck.) The form the segmentation is not distinct the neck.) The segmentation is not distinct the neck. I have been segmentation and the segmentation is not an extension of the segmentation of the segmentation is not attachistic firm to the interest of the protection which can be the pa in the state of the segmentation is segmentation.

well s the segments is spelled. Otherw is the strobula will be reformed from the head.

The head contains the central nervous tissue and the commenceme to of the water vascular (exc et y) system. There is no digestic system from them also before the control of
d ectly from the 1 tests al contents of the best

The profestides may be reg rided as sexually complete hermaph oditic individuals practice by egg fet to ies. They ac covered by an elastic civile along dan their interrogant in elliptical bodies compos d of calcium e rhomate varying from 5 to 56 in a dameter in different spector. These calciume was bodies are characterist of cestode 1 suse. Aside from the sex organs they contain usest each late al margin runn ing the entire length of the worm a set deer now of the scale as pair of exercity or, and which untilly comm. Sets with the opposite canals by a transverse canal. The segments the mature severant a sex the counter of once in Disjoil both simil far when the present is a set the counter of the count

Each segment c stains a central uterus ofte with a varying number of lateral b anches ov ries (near the e tral surface) with line gl ds the secretion of yolk a shell gland in da vaginal feading from the ge itsl porc to the receptaculum semins and to the owdnet From the latter a duct runs to the uterus in which the eggs accumula's Each egg contains three pairs of hooliets. There are also monite testes from three to many in the tape-own soil man a system of collecting thubles and a was defected speams at the gential pore and differentiated at its terminal pottons into an intromittent muscu lat organ the circus Fertilization of own may be effected by speam from the same through the circus.



segment or from other segments of the same worm or of other norm. The egg are not discharged through the gental pore. In Diphylledstriam the eggs are disharded consecutively through a special lattip ore. In Teams there is no both pore. The necessary of the terms and both and eggs are theretized only after dissuffication of the segment. Then occur in the intestine and then numerous egg a may be found in the facers. In other cases one or more matter segments may detach themselves and be p. sed unto it in the facers (which then do not contain eggs). In the case of Teams argued the segment.

may wriggle out through the anus or if facces have been deposited on the ground it may creen away from the faecal mass into the grass and there disintegrate and liberate eggs

in a situation in which they are likely to be eaten by a cow

Life Cycle -Practically all cestodes require both a definitive and an intermediate host. For nearly all species infecting man man s the defi it we host and is usually injured little if at all by the infection The s te med ate host may be another mammal a fish or an arthropod In the Taensomea when eggs are swallowed by an appro priate host the shell is dissol ed and the liberated embryo (ouchosphere) with the aid of its hooklets burrows through the gut wall and penetrates into a suitable tissue where it encysts producing a bladder like structure containing fluid. The hooklets are then discarded At one or more points the cells in the wall of the cyst proliferate and invagin ate to form a scoley. If a single onchosphere gives rise to a single cyst containing a single scoler as in Taenia the structure is called a cysticerous. If it produces a single cyst contai ing many acolices it is termed a see urus as in C o reb alis of sheep (the larval form of Multicees multicees of the dog) If at forms many cysts each containing The term eystecercosd is applied to a cysticercus which many scolices an echinococcus is minute and contains very little fluid as in Hymenolepis When the cyst is ingested by the definitive host the scolez evaginates attaches itself to the intestinal wall and develops into the adult worm

Man is an intermediate host in the case of Echinococcus granulosus rarely of T sel um and a few other cestodes, and may suffer serious injury from such infection.

KEY TO IMPORTANT CESTODE SPECIES FORUM IN MAY

I Head with two elongated sht like suckers genital pores entral rosette shaped uterus Bothriocephaloidea

A Single set of genital organs in each segment Diphyllobotl roum

B Double act of genital organs in each acgment Diplogonop rus
C Immature forms showing characters tos of Bothylocophalo dea (collective group) Sparganum

II Head with fou cup like suckers genital pores lateral Tacmo dea

A Uterus with median stem and a varying number of lateral branches (1) Head with two rows of hooks Many segments. Uterus with 5 to 12 lateral

- hranchen Taensa solsum (a) Head without hooks Many segments Uterus with 5 to 30 lateral branches Taensa sacinata
- (1) Head with two rows of books a to e segments only Echinococcus granula
- B Uterus with ut medi n stem and lateral branches

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- (r) Genital pores single Postellum with not more than two rows of hooks (a) Suckers rmed with numerous small hooklets. Fifteen to twenty testes
 - in each segment Do nea (b) Suckers not armed Three testes in each segment Hym olegis () Rostellum with a single row of hooklets Length 1 to 8 cm. Hymen

olepis nana (2) Restellum unarmed Length 20 to 60 cm. Hymenolepis d m nuta (2) Genital pores double Rostellum with four or five rows of hooks Dipy! d

Tarnsasss

Taema saginata (Goeze 1782) the beef tape worm or unarmed tape worm is found throughout the world wherever beef is eaten. Man is the definitive host cattle act as intermediate host. It is the commonest large tape worm of man next to Hymenolepis nana in the United States It has a world wide distribution In some localities as in Africa and Syria and also among Tibetans one fourth to three fourths of the inhab

itants are reported as infected. The Tibetans prepare beef by broking it in large chunks over an open fire. This sears the surface but scarcely warms the interior. However, in the Hindu sections of India infection with T saginata is practically unknown among the natives since only the lowest outcasts will eat meat from the sacred cow, or even that from water buffals.

Morphology —The adult worm is found in the proximal part of the small intestine It is from 4 to 8 meters long and is made up of several hundred (up to 2000) segments. The small pears shaped head (ir 5 mm) has four pigmented elliptical suckers but no hooklets. The armed rostellum of T solium is absent being replaced by a depression (sucker). The mature propletides are planny about 18 to 2 mm long and 500 mm, wide. There is a single genital pore which usually appears on opposite side of adjacent segments. The uterus has 15 to 30 slender lateral branches on each side which show forking or tree like branching in contrast to T solium which shows 5 to 72 lateral divisions only. There are two onates.

Life Cycle—The eggr are slightly own of about 25 hy 354 in diameter and possess a thin transparent outer shell which a usually lost in the faces. Within this there is thick radially strated layer (the embryophore) containing the embryo proper (the onchosphere) usually with three pairs of hooklets. The eggs can not be distinguished

with certainty from those of T soleum

After agestion by the cow the onchosphere is liberated in the small intenties and penetrates into the tissues especially the daplarg me heart tongue and matteriary muscles. Here they become encysted forming small hidder like structures should by 8 mm in size (hidder owns) containing a small scole but relatively hitle (Cysticerus bows). The absence of looklets about the head distinguishes it for Cysticerus calculates the larva of T solume. They remain quiescent in the much viable for many months at least. All reports of this larval stage in man are open to question.

Indecton—Iluman infection a acquired from consumption of inferted heel on taning the Cynterrul laras. When infected must is eather any or inadequive cooked the cyst wall to dissolved the tooler statches itself to the intestinal wall and gross rapidly see thing the additisting after about two month. The maximum dust turn of life is not known but it at least several years. Cat'lle become infected from graing on ground which has then polluted by burns faces containing the own of the parsuits. Perfold and Phillips (1693) have reported that the ova may remain wable on exposed pastures for S weeks or longer

Pathology and Symptomatology —During the later stages of the incubation period when the parasite is in the intestine and is reaching the adult stage diarrheea and hunger pains not infrequently develop and a loss of weight may occur. What is known as the proverbally ravenous tape worm appetite is common. During the early stages of infection a leuco cross may occur together with an eosinophila which is some instances has reached 34 per cent. Later in the disease there is more usually a slight leucopenia. The presence of the parasite in the intestines usually causes no distinct lesions although mechanical injury may result at times from its obstructing the intestinal earlied and slight injuries to the mucos membrane may occur at the point to which the parasites adhere. In a few instances reports of appendical colle have been made in which the proglottides of the worm became clogged in the appendix. The parasites may also cause digestive disturbances and nervous symptoms due to the production of toxic substances which are absorbed.

Swartzwelder (1939) in a study of 60 cases in New Orleans found abdominal pain exercises appetite weakness and loss of weight to be the commonest symptoms. Other patients may e perience naises difficult breathing digestive di turhances dizza ess restlessess insomn a and occasionally convul mas or epileptic fits. Some patients become greatly emacated.

Chandler (940) reports a case which had been treated for tuberculous. The pitter was seak and easily crhausted and subject to mental disturbances his cheeks were sunken his frame emactated a deyes staning. Within a fortinght after s large Tuents had heen expelled h a cond to make entirely changed for the hetter although had been suffering for over a pear. On the other hand many classes remain nobust

health and re eal almost no symptoms of infection

Prophyla depends upon adequately cooking beef adequate inspection of all meat
and sanitary disposal of human facets
The parasites a e easily killed by heat They
are also killed by thorough sait ng and by refingeration for three weeks or more It is

probable that the various raw meet cures have made the infection more common Ahnormalis on of both the soles and the propletids are common. Several related species which have been described are believed by many t be merely variants of T argumes as T ordigars in the Unit of States Nugarian and East Affance (a cases) T f t a B Affance t (cases) and T phirtpines in Philippines T b emm t case in Nugaria, etc. For east of sees t 1422

Teens solum (Linnaeus 1758) the meash port tape worm has a word wide distribution and may be met with wherever raw pork; a start it is very rare in the United States Canada and England but is fairly common in north east German and some other parts of Europe especially among the Slavic peoples. It is not found in Jens Mohammedans or other races that do not eat pork. Man is the definitive host and the hog the normal intermediate bost. However man may serve as inter mediate host of the larva and this form of the infection (Cypitecrus celluloiga) is commoner or more often recognized in man than infection with the adult parasite.

In many parts of the world s n N th America India and the Phil ppines Chandler points out huma infections with adult worms are stare that many laboratories are unable to obtain specimens of the pas as tel or instruction by thildder on mifection (Cytheceus) n pags as of faulty frequent occur e ce. This is yet unexplained. The purk however in out to only in the most part of the hinder worms.

L' $f \in Cp/e - M$ ien man a núe tel sego mis mojle in chains are capelled from the intestines almot clairly. I requestly see rall hande of are pas of during the month each segment contain g thousands of eggs. E ther before or after leaving the body the pr glot of by their was movements free cutry ruptur the utreus ant morly and the pr glot of q the region of the q start of q and q the region of q the region of q and q the region of q the region of q the region q and q the region q the region q and q the region q the region q and q are the region q and q and q are the region q and q are q and q and q are q and q and q are q and q and q are q and q are q and q are q and q and q are q and q and q are q and q are q and q and q are q and q and q are q and q

intestinal wall and make their way through the blood or lymph channels usually to the muscles or meat often localmage in the tongue neek and shoulder muscles the any issue or organ may be involved. When they arrive at our estimate the blood into bladder worms or Cysterceus cellulouse. These are such as the blood with an opalescent transparency 6-18 mm long with a denser white upon on one use where the scoler is invaganced. Such park is called measy pork Development takes about 3 months when they attain a diameter of 6-12 mm. They may reman viable in pork for years.

Human infection is acquired when undercooked pork containing the bladder worms is eaten by man. The scoler is then digested and the fatter turning right side out, anchors itself to the wall of the small intestine and grows to maturity in about 2 or 3 months. While considerable growth of this parasite may take place in dogs man is the only final host 50 for as is known.

Symptomatology and Pathology -The adult Taenia solium in the intestines gives rise to the same symptoms as described for Taenia saginala (see above) In many robust patients the symptoms are not very dis turbing Honever rare cases have been reported in which the scoler had apparently perforated the intestinal wall, giving rise to peritonius Also T solium is particularly dangerous because the larvae or bladder worms as well as the adult can develop in man. Thus if the eggs are ingested by man or if self infection with the eggs results (either from con taminated hands or by ripe segments of the parasite being carried back to the stomach by reverse peristalsis) the embryos may be liberated there by the action of the gastrie ruice and after migration into the somatic or visceral organs give rise to cysticercosis. In such eases any organ of the human body may become infected including frequently the brain and occasionally the eye In such localities the cysts may become quite large and cause grave disturbances. It is therefore very important to identify the adult parasite when present to enforce rigorous precautions to avoid ingesting eggs and to institute treatment promptly

Clinical and Pathological Features—The effects produced by the Cysteteria Irm and repend upon the severity of the infection and the location in the body. He was a constant of the control of the infection and the location in the body. He when situation II mover when the parasate locate in the eye heart spinal cord orbit they may give rise to alarming or serious symptoms especially as a result of mechanical pressure. They have been found most frequently in the substancous issues to infection of the brain is very frequent where they have been cocountered commonly in the ventricles or in superficial cysts and may give rise to convolutions epideptic attains and paralysis. Next to the brain in order or frequency they have been found in the eye the muscles heart liver longs and abdomnaticavity.

eye the musicies near liver longs ama autonomiat cavity.

The presence of the growing larvae in the issues usually gives rise to a local inflam matory reaction and inflatiation of the area with lymphocytes neutrophiles essionphiles and plasma cells. Later the Cytheseuse becomes surrounded by a libroux capsule Giant cells may appear. In other mataness necrosis may occur and be followed by castation or calcification of the larvae. The calcined cysts act as foreign bodies in the

brain
Chinically the infection in the brain is a common cause of convulsions and epideptic
attacks. Such attacks and their common occurrence have in recent years been empla
sized particularly by MacArthur (1934) Dizon and Smithers (1934) and Chining and Lee
(1935). MacArthur has shown that the frequency of epidepsy in the Enitsh Army

especially in soldiers who have served abroad is due to cysticerous of the brain. In some malance tearbul tumon in due her suspected before correct dampons of cytucerous was made. Nervous tymptoms other than fits may occur and the initial symptoms may resemble dissemmented selerons. Psychical states have been reported with cerebral iritability or loss of memory. Even acust manu or melanchola has been object ed.

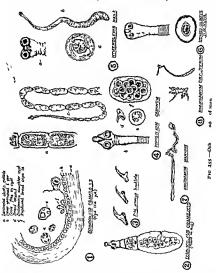
Diagnosis of the intestinal infection with worms of this genus can sometimes be made by finding eggs in the faces but the species cannot be identified in this way. Precise diagnosis depends upon finding and examining a segment of the worm. This should be mounted between z sides and compressed sufficiently to make clear the lateral branches of the uterus. Prizy on each side as distinguished from 15-20 for T signate. A thirt an authelimite all the stool abould be saved and screened and the sediment thoroughly scarched for the freed using a hand lens. If the scoler is found the armed rostellum differentiates the para site from T signates. If the head is left behind a new worm will develop but a or 3 months may clap e before eggs or segments reappear. There may be several worms present.

Dige on | Cyrice costs -In cases of epileptic attacks or similar nervous symp toms a careful search by palpation should be made to discover any cysts. They may be the s ze of a small pea a hazel nut or even a pigeon s egg Their distribution varies They have been found in the hips masseter muscles in the i saues of the neck chest abdominal wall back and groin. If they are not numerous they may easily be over looked. At the time of examination they may be absent, but appear at a later date Radiological examination may a t se eal them as calcification u unlly doe not occur hef re se eral years after infestation If cysta are demonstrated they should be excised whole under novocain anesthesia and the ettire host capsule removed care being taken not to injure the cysticerous. When the parasite becomes calcified a good skiagram will frequently reveal it as a small ele gated shadow. Manson Bahr reports that evidence of calcification within the brain has been demonstrated in a cases. Unfor tunately the cosmophile count a no aid to d agnosis as an no cas a so far invest gated has an I crease been sh vn Complement fixation tests have also not been of great Value since in some insta ces a negative test does of exclude the infection and the inte dermal Casoni test was positive a only about half the c ses

There has a been see ral fatal cases in which the cysts were found at autopsy limited to the brain. No constant chan es have been found in the excelor spinal flu d. Some times the epl pit c seiz res cease without apparent cause. In other cases they have persisted for 8 years or more.

Prophylaxis—Since consumption of ray poth may expose the individual to infection with the pork tape worm as well as to trichnosis insufficiently cooked pork should be carefully avoided. Public instruction should be given especially in the schools of the danger of faccal contamination which makes it possible for man to acquire cysticercosis either from himself or from others infected with the adult worms. Saintary laws should be enforced regarding the disposol of human exercitation enforced regarding the disposol of human exercitation enforced regarding the disposol of human exercitation enforced materials and rigid inspection of pork in all saughter houses carried out and condemnation and destruction of meady pork.

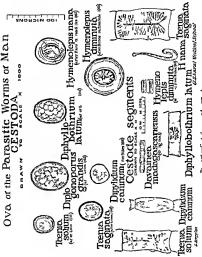
With reference to the destruction of eysticeres in pork the parasite is killed when heated to 55 C hut the difficulty of heating the center of a large piece of meat even to this point is shown by the fact that in an experiment made to test the penetration of heat a ham cooked by boling for a hours had reached a temperature of only 46°C in the center. It is advised that when there is any question of infection the po k to be reasted



should be cut into pieces weighing no more than 3 or 4 pounds to insure thorough penetration of heat Pickled and salted pork are not neces sarily safe

It is commonly believed that human ejsticereosis is an accidental complication occurring in the host with an adult tapeworm the auto infection being caused by the ingestion of eggs or possibly by regurgital

tion of segments into the stomach Manson Bahr (1940) believes it is much more probable that the infecting eggs are conveyed from some extraneous source and it is possible that the infection is acquired in some



way from pigs by eating sausages made from the intestines or through some contamination by pigs excreta (For treatment see p. 1472.)

Hymenolepis Nana (Siebold 1852) (Taenia Nana)—The family Hymenolepid to contains a large number of species of tape worms parasitic in birds and mammals. Three species have been found in man Hymenolepis nana which is very common in both man and rats and

mice *H* diminula is abundant in rats and mice and fairly common in man and *H* lanceolals (Drepandotaenia lanceolala) a parasite of dos and geese which has been reported in man only once and the infection may have been accidental

H nana the dwarf tape worm, is the smallest of the human tape worms and the commonest in the United States It has a world wide distribution but is of course, commoner in some localities than others and is particularly encountered in warm countries

Stiles found it in 5 per cent of the children of a Washington (U S) orphinage and its estimated that about 1-9 per cent of the population especially children as run feeted in the southern United States. Sunkes and Sellers (1937) in a study of data from faced examinations in the southern states obtained records of 8.05, tipe were miscules 9.8 oper cent were II none. It is also common in Brazil and Argentina. Egypt the Sudan Sama and Japan. Apparently it is less common in parts of China. Wang (1938) in Peiping found it in 0.33 per cent. Chandler (1930) found no more parts of India as high as it 8.3 per cent of the population infected. It is found thou but Europe but is particularly common in southern Europe. In Portugal Symin 60 Sindy according to Caldructon to per cent of the fieldern are affected. Its dutributions is generally more common in warm than in cold climates. It is probably identical with the common rat tape worm which as been appealed in non-little in the common rat tape worm which as been anneal. It may little in the common rat tape worm which as been anneal. It may little in the common rat tape worm which as been anneal. It may little in the common rat tape worm which as been anneal. It may little in the common rat tape worm which as been anneal. It may little in the common rat tape worm which as been anneal.

the common rat tape worm which as been named II most federas
The adult worm is usually from to to a orm long (extreme soon map nod a; it
of man wide. The physical ray so small and delicate that it resembles is straid of ment
of man wide. The physical ray so small and delicate that it resembles is straid of ment
of the sought for it contains from no to so so sognements from or to a 12 mm long. It has
lateral gential pores all of which are on the same ade. The head (o 3 mm) has 4 yet
are the rated by disintegration of the terminal segments. They have a very character
site appearance. They are spherical or oval about 100 kg 3 mt diameter colories
and translucent. There is a thin outer membrane and an inner in mbrane lawing a
some about 1 ya wide between them. The later encloses the learnor is higher distributions
where the source of
The adults live in the upper ileum and are often numerous 1000 to 1500 or more. They may then give rise to gastrointestinal and nervous disturbances.

Life History—Unlike other numbers of this group the parasite requires no lister mediate host as was demonstrated by Giassa and Rovells (1883, 1892). In raise and probably in man the fully embryonated eggs after angestion pass through the stomath into the intestine and then blerate the embryos (nonchospheres) which penetrate into the with and undergo encystiment forming a cysticercoid. After a days development arotelulum ant bhooklets appears. The larva then leaves the whils are enters the limited of the intestine and attaches itself elsewhere to the mucosa. It develops to maturity in about 13-20-0437 so that after about a month eggs appear in the faces. It is therefore easy for the host to become superindected if faces are conveyed to the month by durfy fingers.

Epidemiology and Prevention—With this parasite as it utilizes no intermediate host infection apparently is transferred commonly from patient to patient. Some on vers believe that man is probably the only common source of human infection. However there has been much dispute as to the identity or otherwise of II made from an and off. If man infertion is the infection of man and it is the inferior of mice and atts. Which human infections has been relatively rare in some northern localities in Europe and Canada where the product infection was common in warmer counterly where roduct infections are all Commonner human inferiors.

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frequent also. Grasus has suggested that the human and munne strains are identical. Several investigators have infected children with ova from minne sources and Wood and has infected mee with ovar from human sources. Shaw (1932) reported that a murine strains were physiologically as different from one another as they were from the human strains.

Chandler in India has found an inverse correlation between the incidence of H nana infection and that of such infections as Ascaris and Trickurss which definitely depend on human faccal contamination for transmission. On the other hand he found a high incidence of II nans infection to be directly correlated with the prevalence of house hold rodents and conditions favoring their access to food and with such rodent borne infections as plague and with Hymenologis diminute. He points out that in the south ern United States H nana infections are about equally common in cities with sewage systems and in rural areas and that this is more suggestive of dissemination by rats and mice than by human contamination. The frequency of heavy infections is a further argument in favor of the important role of rodents in transmission for while the accidental swall wing of a small p rtion of mouse e crement with food could easily convey one or more whole segments of the worm with hundreds of eggs such a wholesale con tamination from human faeces would be improbable. The question is an important one from the standpoint of prevention. Chandler believes that human infection is commonly acquired from ova derived from rodents and that hence infection can be avoided by preventing access by rodents to human food which is to be eaten without further cooking. However as it seems probable that infection in man may also be due sometimes to ova derived from another infected buman being sanitary measures in the disposal of excreta are also necessary to prevent spread of infection

Symptomatology —The parasite in severe infections may give rise to systemic toxaemia with nervous manifestations especially in children They may suffer from abdominal path diarrhoes convulsions epideptic attacks and insomnia

The diagnosis is usually easily made by finding the ova in the faeces. Like nematode ova they float in strong salt solution

Trealment is considered on D 1472

Hymenolepis diminuta (Rudolphi 1819) (Syn Taenis diminula) the flavo punctate tape worm of rats (R desimensus Ratius divendrinut) has been found in more than 200 human cases. Recently 11 has been reported more frequently sepecially in India Soviet Russia the Belgian Congo Japan Italy. South America West Indies and in the southern United States Chandler found 23 cases in about 10 000 faceal examinations in India and no less than 3 in 50 examinations in one locality where the food habit were particularly favorable for infection.

It is much I gr than If nor measuring so to focm long and about a min wide containing about 1000 segments. The mature segments are frow of than they are long. The shed carrier wall suckers and a rootellum without hookits. The ovar exemble the preceding but a clarger 50 to 800 have a thicker 7 daily strated outer membrane and no fit me ts. The meterned ate host are vario a species of insects and my rapods 1 dud g med and grain insects and the rat files. Infection occurs by swallow g an infected untrends the bost and the rat files. Infection occurs by wallow g an infected untrends the bost. The infected unsets he a been found in direct frusts breaklast ex each et each is vector having become letted from mouse dropping.

Drepandotaenia lanteolata (Bloch 718) (Syn H lanteolata) common in gress and d cks h been reported once in man in Germany. It is f om 2 to 22 cm long and 0 to 2 mm w de 11 has a small globular head with a rostellum bearing 8 hooks and a sh et neck.

Dipylidium caninum (L nuaeus 1758) (Syn Taen a canina) the common tape worm of cats and dogs and other carnivora has been found occasionally in man chiefly in

children It is 15 to 30 cm long and 3 mm in maximum breadth. The segments are shaped like melon seeds 8 to 10 mm long and have bilateral gental pores. The head has four suckers and a rostellum with 30 ct 4 ross of energing looklets. The eggs as aimlar to those of II mens but are grouped in packets of 5 to 20 in the faces. Eggs registrated spossed on the ground may be ingested by the larval stage of fless. Infection is acquired by swallowing infected dog fless. Clenocepholides nod Police or the Tricholoctes carries which constitute the intermediate hosts. Children may sometimes become infected in playing with dogs by crushing fless on their hands and conveying the owa on their fineers to their mouths.

Radiletina midagastariensis (Davaine 1869) (Dynaine midagationieni) nor mally a pravate ob briefs has been reported in a few human cases: (Madagaster Sun Britah Gusana Formosa Philippines). It is 24-39 mm in length by only 15 mm die. The gential pores are unbiateral. The head has 4 deeply excavated suckers and a rostellum with 50 hammer shaped hooklets in 2 rows. The clongated over 50-50 by 19-232, are deposted 54-50-71 in a packet containing a spherical cochonplere 5-150 in diameter. The cockrocals genus Periplanets is thought to be the intermediate both. The complete the cycle 10 indiamon. A closely related species R auminemia. Each

1945 has recently been reported from Outo Ecuador

Although for many years almost all of the human infections have been supposed to be due to the species R modapscarrensis according to Joyeux and Barr (1970) and Dollius (1974-00) many species are involved but these minor distinctions are of interest only to the soologist. The human cases undoubtedly represent accidential infections while the infection occurs naturally in local wild asimilar Honever in only 10 localities formous and the Philippines have the parantes been found elsewhere than man in both these instances in rats.

TREATMENT OF TAPE WORM INFECTIONS

The drugs which have been found most useful in expelling tape worms include

(t) A group of vegetable extracts from felix mas or male fern cusso and kalmala all of which are derivatives of a substance known as phloroglucin

(2) Pelletierine an alkaloid derived from pomegranate bark

(3) Arecoline and allied alkaloids from areca nuts

(4) Melon seeds obtained from Curenbila maxima

(c) Carbon tetrachioride (CCla)

employ

(5) Carbon tetrachloride (CCIs)

Most observers believe that felix mas or male fern is the most satisfactory drug to

For efficient treatment preliminary starvation for one or 2 days is advisable and unless this is carried out for at least 24 hours the treat distance of the consisting of sodium sulphate ½ or to clear out the intestines. This purge had best be given during the late afternoon. It is advisable that only liquids or broths should be given during these 2 days. The and coffee may be taken in himted quantities without sugar or cream. This preparation of the patient is required in order to facilitate the film mas coming in contact with the bead of the parasite. If this does not occur the uninjured head may remain buried in the mucosa and protected by mucus and if this occurs now segments will regenerate in a few weeks.

On the third morning of treatment oleoresin of aspidium (Dryopteris felix mas) should be administered in gelatin capsules for adults each con taining 0 6-1 2 cc (10-20 minims) for children—1 minim per year of

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age one dose being given for example at 8 am a second at 8 30 am and the third at 9 am

The patient should then be perfectly quiet in bed and take nothing other than a few spot of sack tax orwater. At no pan in My out of sookim subplate should be given and the bowles should be freely moved by the saits. All the movements passed during at hours after treatment must be averd and strained and a sack made for the head Segments of the parasite usually appear after the dose of the saits but the lead may not be passed until later or noted until several days after the ceasino of treatment. Therefore failure to find the head at first does not necessarily indicate that the nature coap and safter enum should be given which may from a way the head. Even if the bead is not found no repet too of the treatment shi uld be given until segments of the parasite again appear in the faces.

Food may be commented after the bowels have moved thoroughly following treat ment

ment in success of the treatment may be dependent in part upon the potenty and fresh most of the dup. The extract of as spudum may be presented at its is more refined than observed the state of the present of the state of the state and a spate to easily woming it also be the presented in gridant reputiles—t capsules of 18 minims each in 3 does . Since a number of cases has excurred of posoning from the use of appoint most motorers prefer to give smaller does of to minims for a adult and not to exceed a main per year of age for children. Aspidum is especially contrandicated in nephrits and presenary. A standard preparation extrausive simply employed has been the combination of 8 grams (a frams) of other acts of make the application of the state of the position of the state of the present of the state
Tone manifestate os of the drug are duraneess c amps and cyanosus. Sunt biblindess has been reported from too large a dose and Sitts notes that the man must biblindess has been reported from too large a dose and Sitts notes that the man must dose of the e tract is about 8 grams and that 1 a grams has caused death. On account of the tomorphy of the drug at times observed some chinactons priefer to treat the state of the drug at the contract of the drug at the desired some charge of the drug at
Pelleterine has been shown to be effective in the treatment of tape worm in only about a third of the cases. It may cause giddiness and weakness of the limbs and large doses may affect the eyeight even to the extent of temporary blindness. This drug is therefore not recommended and it is especially unistude for the treatment of children.

For patients who prove refractive to treatment with aspidium carbon tetrachlonde may be employed but in dose not in excess of a cc for adults. Since however this drug may have an injurious effect on the liver and may be dangerous or even fatal in individuals deficient in calcium it should be preserbed with causion. It is contraindicated in patients suffering with nephritos or fever and in pregnancy. It may also be dangerous when ascars infections are present since it has an irritating but not destructive effect on these parasites and may cause them to form a tangled mass which blocks the intestine Mackie (1941) thinks the patient should be placed on a high carbohydrate low fat and low meat diet for at least 2 or 3 days prior to treatment, alcohol must be withheld during the period prior to treatment Food should be completely with held for 4 or 5 bours after the drug is administered and until catharsis has been obtained by a dose of magnesium sulphate (see also p 1472-3)

Tetrachlorethylene which is considerably less toxic has been found by Maplestone and Mukern to be ineffective for the treatment of tape worm The other drugs which have been mentioned as pelletierine arecoline

and melon seeds are generally regarded as much less effective for the treat ment of tape worm

Manson Babr (1940) beheves that carbon tetrachloride which anesthe tizes the tape worm is especially useful when combined with oil of theno podium. He recommends that it he combined in the following mixture

Carbon tetrachlor Ol chenopod Paraff ho	m	1 (35 cc) v (088 cc) 1 (28 42 cc)
	in 2 doses, as in ancylostomiasis	

receive the full dose children under 6 yrs 2 dr up to 8 yrs 3 dr, up to Half an hour 14 yrs 4 dr The mixture should be made up fresh daily afterward the patient should be given a saline aperient siana frequently is a most difficult tapeworm to dislodge Hymenolepis The success of treatment should he determined by a search for the eggs after a few days since this parasite is so small and so like a strand of mucus that it is frequently not detected in the faeces even though it may have been expelled

Maplestone and Mukern (1939) have reported success with gentian

solet

They treated 12 cases with an adult dose of 1 grain 3 times a day for varying periods. In some cases the eggs disappeared after 6 days. In a number of cases the drug had to be stopped on account of vomiting and in other cases after 3 courses of treatment the ova were still present a

month after the last (see also p r234)

Treatment of Cysticercosis — Treatment is usually most unsatisfactory Intravenous injections of antimony tartrate have been suggested but the tissue changes which usually follow the death of intracerebral cysticercae may only give rise to further disturbances and increase the severity of the symptoms In a few instances in which temporary amelioration of the symptoms was reported after removal of one or more cerebral cysts death of the patient followed later It would appear that any attempt to localize and remove surgically cerebral cysts would be unjustifiable Luminal and bromides have been recommended for controlling and preventing the fits

ECHINOCOCCUS DISEASE (HYDATID DISEASE)

Echinococcus granulosus (Batsch 1736) (Taema echinococcus) (multi locularis Leuckart 1863) is a parasite of the dog wolf and other carni vores the normal definitive hosts. The cat can be infected. The usual intermediate hosis are cattle sheep and hogs but man and many other mammals may also be infected. The disease occurs wherever man lives in such close association with dogs that the hands or food and drinking water may become contaminated with their faeces

Geographical Distribution -It is common in Iceland especially in earlier years and in parts of central Europe North and South Africa South America south of Brazil especially Argentina and Uruguay and Australia and New Zeal nd It also occurs freque tly in Arabia Siberia Turkestan North China Japan and the Philippines Rose and Culbertson (94) state that at present the world incid nce of hydatid disease is highest in Australia New Zealand Uruguay and Argentina. It is rare in man in the United States but is not ancommon in a time in some parts of this country. How ever the 1 cidence of hydatid d sease in the United St tes has never been accu ately McGath 1017 reported that less than 500 cases of the disease were reported in medical I terature of North America between 1880 and 016 The patients suffering from Echinococcus disease in this country were almost invariably (95 per cent) f und to be immigrants from areas abroad where the di ease is endemie. The majority of the pat ents in this country have been nati es of Italy Greece Germany Russia Poland or Turkey I this series of cases 3 persons acquired the infection locally in Cs ada and ro in the United States Sawitz 1938 has reported 8 additional cases occurring in Louisians. The e e no important endemic for of the disease in the United States and only about 25 human cases (native born) in which the infestation is bel eved to have been to tracted in this country Schwartz (1030) also finds that there is a lancidence of byd tid injection in sheep cattle and hogs on this continent In view of these f cts and also since dogs rarely have access to the viscera of slaughtered animals in this country it seems unlikely that hydated disease will ever increase aignifi eantly in nati e born Americans

Tie Parasite -The dult worm has in the small intestine of the dog and other definitive hosts where they are att ched to the vills. Though structurally much like other tape worms the parasite is very unlike in size measuring only 3 or at most 8 mm in length and consisting of a scoler and neck followed by only 2 or 4 successively I reer segments the first of which is immature one or a mature and usually one ripe This segme t the terminal one is a wally larger than all the rest of the worm and is generally packed with ova The head has 4 suckers and a rostellum encircled by a double to f hooklets usually 30-36 Very large numbers of the worm occur in the 1 testines of dogs. Handreds or even thousands ha e been reported. They are frequently overlooked o account of their minute size. Nevertheless they require from 4 to 6 weeks to mature in the dog Each ripe segment of the parasite contains

from 500 to 800 ova

The ova in the faeces of the dog closely resemble those of T sag ala or Multiceps nd cannot be accurately different ated from them. They measure about 30-38 u They are exp lled free or in the ripe proglottides in the facces of the dog often in pas tures and they gain access to sheep or cattle their usual host through contami ated fodder or wate Many other animals become infected including monkeys ruminants carm o e rabbits horses a d camels. In Africa, the writer found the wart hog which were shot naturally injected with hydated. Human injection usu lly results from ingesting co taminated water or food or f im too intimate association with dogs Children are hable to infection by allowing dogs to lick their faces

Pathogenesis -- Man is parasitized only by the larval or hydatid stage of the parasite. In the digestive tract the ingested eggs lose their mem branes The liberated embryo penetrates the mitestinal wall and within 8 hours passes as a rule to the liver (60 per cent) probably through the portal vein. In some cases it is carried to other organs especially the lungs less frequently to the kidneys spleen intestinal wall peritoneum heart genital organs brain or to almost any organ or tissue but as a rule only one organ is affected

The lars a penetrates 1800 the insues and becomes encysted. The cysi develops wall with two hyers. (c) The outer layer as theck luminated and elastic to that carls up when mencal. (a) the erwer layer as made up of a protophismic matrix onlining numerous muche. Around the cysi there is also a connective resus cap. 16 formed by the issues of the bost. Thom the name or genomal layer bud like processes are with the scene resculpt and agree termed broad estated. By a process of locking the contract of the cont



Fig. 357—Echinococcus costs in different stages of development and grands giver cost in which inverted suckers and booklets are until (Hari & Afro an Report)

prohiteration and invagination of the wall of the broad capsules numerous scalars are produced. Each scolect is about o 125 mm in diameter: n borne on a pedi le and shows suckers and five rows of hooklets. Some of the broad capsules separate from the walls and settle to the bottom of the cyst as a fine granular sedment known as hydated sand bettered scolects also may be present.

As the cyst (bydatud) gendrally enlarges (reaching a diameter of about 10 cm after 10 months) museumations of the wall may give rise to accordary or diagnite cysts (possessing a laminated external layer as well as a germinal layer) but such tyst usually arise by development from brood capsiles are societies. From them grad daughter cysts may turse in a similar manour. In each there is a continuous formation

of brood capsules and of scoleces in each capsule. Growth may continue for several years (2 to 8) and the cyst may become as large as a child a head (although usually they are much smaller? It has be nest in telf that as many as 2 000 000 scolects may thus area from a sigle own. Occas on ly a cyst is barre contain no scolects. When the contents of a cyst are eaten by a dog each scolect may develop into an adult worm.

In some cases in which no effective encapsulation occurs the daughter cystal develop as a restill of evaguation of the cyt wall. This results in the formation of a mas of small discrete venicles like a bunch of mustale grapes which tend to indilitate the sur rounding its sizes and even to metastaze to other organs like a malignant tumor (Gallerthreben). They occur most often in the liver especially in cattle. Because these in like is lo or all eads by it of air common in man mertan it attents (outbrind these in like is lo or all eads by it of air common in man mertan it attents (outbrind).



Fig 358 - Ech nococcus cy t wall with a ruptu d b o d e p ul showing seol ces (From U S N v 1 Mech at B tlet n)

Germany R sna) but are almost unknown in others (Iceland Australia) some have regarded the paras te as a distinct species E mult locale is the present evidence is against the date that this is a distinct species. Chincel Symptoms.—The cysts eventually cause grave injury as a result of pressure

a destruction of the organ involved. In the liver the early stages are usually symptomless or a tumor may be felt. Large exists on the course surface may be mustaken for a pleural effusion. If the contents become infected the symptoms are those of shaces. Empiric may occur sport couply either into the persional cartyly pleurashaces. The content of the couple of the couple of the couple of the couple of the violent fraction which may be fatal. As emis constitution and the couple of the death usually occur within a few pears miles complete suggical removal is possible.

Involvement of the lung may occur in as much as 12 per cent of the cases in some series and is even more serious. The cysts are most often in the right lower lobe. The early symptoms are cough shight hasemoptives and transment fever Localized râtes may suggest early tuberculosa. Later the symptoms and agas may be those of tumor or absers. Rupture may occur mus o bronchus the pleural eavey o robt, la such an accident is not quickfy fatal recovery may occur is pontaneously or after susticle surgeal draining. The sharp outline of the cyst in rorangenous accident scale activities. Eostrophilia is often present. Hooklets may usually be found in the sputim after rupture into a bronchus if scarch is proloned.

Diagnosis —Clinical diagnosis is often difficult. Since the liver and lungs are especially involved and the other organs much more rarely infected differential diagnosis is usually a problem of the consideration of abdominal and pulmonary disorders.

The symptomatology is in so way characteristic and the disease may at times simulate hepsiate curribous cholegatistic abscesses of the liver and lange sarly tuberulo as and various new growths among in the chest or abdome. Degenerative cysts will requestly und reg califoration in which case they may frequently be detected by Nray cramination and present a typical appearance. Expirer of the cysts occurs and infectionally and may be followed by severe or even fails anaphylyicite restroot and changeous can be much by the finding of charge strong through the control of the

However a definite diagnosis may be made

1 By examination of fluid from a cyst obtained at operation (or autopy). Emploit atory appration is dangerous. It leakage of fluid occurs or it a cyst reputies a world reaction anaphylaction in type may follow and an eosinophila (confined to the region of the cyst) may occur. If sochies are scattered they tend to become implanted about to give reset to new cysts. The cyst fluid is clear and according to some analyses contain about to give ented Nicla is traced single and no albumn. Excording to lemante side Ribert (1935) it may have a specific gravity of a or plus a pH of c and give process of the cysts of

is also decisive

2. By the precipitin lest of Welch and Chapman. Equal parts of patient's serum
and clear hydaud cyst fluid are mixed and incubated one hour at 37 C. A positive
reaction (a precipitate) is obtained frequently if the antigen is good but fall c positive.

reactions occur

3. By the complement fixetion fest of Weinberg and Parvi. The usual Wassermain technique is followed using as antigen o.e. (o. p. fo jo fix the intemplementary does) of cest fluid. The fluid may be obtained from sheep cysts and is filtered carboir of and inactivated before use. The results appear to be reliable but there is difficulty in preserving the antigen. Fairley and Kellaway (1933) who have had extensive enjoyer acce in Austrials with both these tests and the Cason test to be described presently obtained positive reactions in about 85 per cent of the cases. However they thought the Cason test to complement fixation one.

A By caloneous ellerg c feris (I yes described by Cason 1973) About o a c of bydard over thou is superfur directorusally or applied to a scratch A positive reaction consisting in the rapid appearance (issually m so minutes) of a large wheal with a some of crythema has been reported in about op per cent of the cases. There may be a marked secondary late reaction also. Sensitiveness may la t long after removal of the case.

Dennis (1937) has prepared a more stable hydatid antigen from cysts of infected cattle and sheep by centrifugation and evaporation. Dry precipitate was obtained dulted j to coo in physiological sall solution and o z cc of the antigen employed.

for an intradermal dose

Rose and Culbertson (1949) have pounted out that neither cutaneous testing nor complement fraction have been employed meany countries as in the Unted States on account of the scarcity of hydated dawd. Also the different samples may show wide variations in antigenic potency and the specimens deter orate more or less rayely. The observations of several investigators have suggested that the Casoni and the complement fination tests are not species gased the attainly group specific and the complement fination tests are not species species bed at actually group specific and the complement fination tests are not species species bed at actually group specific and the complement fination tests are not species species and the species of the

Rose and Culbertson have prepared antigens from (t) Cysticeres: pisiformis: a larval stage of the dog tape worm Taena pisiformis—(Sp. T serials) which occurs naturally in the liver of rabbits and in from 50-0 per cent of stock laboratory rabbits and (s) from Taes a tast set | m : the adult tape worm found in the intestine of ats and very common in this summer bence natiges from both are easily obta pable.

The antique from Taesia pair from its prepared by dissecting out the larvae from the cysts. They are then triturated under sterile conditions in physiologic salt solution contain ago ago ere cent planed. The supermated fluid is used after centrifugation and final steril atton. In the case of Taesia taessage mit the antigen is made from the adult parasite found in the intelligence of the case prepared in a somewhat similar manner adult parasite frought in the first prepared in a somewhat similar manner.

They have performed cutaneous tests in 14 patients suffering from Echinococcus disease. Positive cutaneous reactions were obtained in 11 out of the 14 cases. They also obtained a complement 6 atom tests with serious of 7 patients with known hydatid

disease with these substitute antigens

Transment.—All trentment other than suggest has proved to he unsuccessful Surgeal procedures are of benefit only as the case of un locular cysts in nites with char operable. If removal is attempted the cyst should be exceed intact or else the wall should he satisfact to the should as a strictly only as a wall and allowed to heat hyp a causation (may supealarment). It is adversable to imper some any expect fluid into the cyst to kill the terms the contents of the cyst.

The dangers of withdrawing fluid directly have alse dy be n referred to and it has been suggested that it is desirable after asy mation of a portion of the contents to immediately inject — p. Ect of a to per cent formalm solution to kill the scolices broad cap suits etc and then withdraw the fluid in gampates before preceding to the removal of the cystle. Some surrectors priefer to close the cavity without one draining as the

procedure known as marsup alization requires longer hospitalization

Prevention—Since human infection may result from fondling infected dogs or perhaps from ingesting owa of the parasite from the ground on which dogs have defecated or on vegetation contaminated with their faces: thorough washing of the bands before cating is advisable. Dogs should be prevented from eating the carcasses of sheep cattle and hogs in the endemic areas. The disease has been greatly reduced in Tecland in recent years as the result of a campaign enforcing the burning or burnal of infected material and of the law controlling dogs by trastion and treatment Lack of personal hygiene among sheep breeders in Augentian has apparently been responsible for a considerable increase in human infection in recent years. According to Greenway the disease quadrupted in that country between 1901 and 1921.

FISH TAPE WORM INFECTION

Diphyllobothrium Intum (Linnaeus 1758) (Syn Dibothriocephalus latus) the broad Russian tape worm or fish tape worm is common in Scandinavia the Baltic countries Russia Northern Italy Switzerland Bavaria Rumania Palestine Siberia, Central Asia, Japan, Central Africa especially among the natives around Lake Ngami

In some localities in Europe 80-100 per cent of the people are infected. In East Prussia Chandler asserts nearly all the fisher folk become infected by eating raw burbot liver spread on bread In receot times Baltic immigrants who came into the United States in connection with lumbering operations have been responsible for the establishment of endemic centers to northern Minnesota and Michigan southeastern Manitoba and the lake districts of Ontario Except possibly for Africa the infection is not indigenous outside the cooler zones of the northern hemisphere. Man is an important host and the parasite is also harbored by dogs cats and bears which become

Morphology - The head is ohve shaped 2 5 mm 10 diameter and has 2 deep suctorial infected by eating raw fish grooves (bothria) on each side but oeither rostellum oor hooklets. The body stiams a length of 30 feet (rarely even 60 feet) and may contain 3 000 or 4 000 segments which are about 13 mm rarely 20 mm broad and 5 mm fong If several worms are present they are smaller The uterus is rosette-shaped and there is a ventrally placed genial pore Each mature segment is continuously discharging eggs which are present in large numbers in the facces (estimated at 36 000 per day). They are operculated brownish in color 45 by 70m with a thin shell enclosing a central mass of granular

Life History -When the eggs reach fresh water if the temperature is isvorable spherical segments segmentation proceeds and after three weeks the operculum opens and a chasted embryo the coracidium (six hooked onchosphere) 25 to дон escapes. It can hve several days in water swimming about until it is swallowed by a cyclops (C strenus) Diaptomus gracilis D oregonensis etc.) the first intermediate host. It loses its ciliated covering pierces the gut wall and after as days development in the ti sues becomes a processed large an avoid structure you long with a spherical protuberance at one end containing six hooklets. When the cyclops is eaten by certain fresh water fish (pile pickerel perch trout salmoo etc) the second intremediate host the larva penetrates the stomach wall and passes into the muscles or other tissues Here it develops into B persected larse of spargarum a worm like organism 8 to 16 mm long with suctoral grooves at its anterior extremity When the raw fish is eaten by man or other suitable definitive host the lars as liberated in the small intestine and develops rapidly into the adult form. After 18 days it may reach a length of two feet and begin to discharge It may live for years even it is said for 16 years

Pathological Effects - In many cases the symptoms are not noteworthy The common effects of infection are abdominal pain loss of weight and progressive weakness, and other disturbances referred to under infections with Taema saginala (see p 1464) Tarassov (1937) after experimental self infection suffered from marked abdominal pain lost 171/2 lbs in weight and became so weak that it was necessary for him to enter a hospital

This parasite however is unique among the other human tape worms in that for many years it has been associated with a very severe anaemia of the permetous type in which the corpuscles may be reduced to one million per cubic millimeter or less Such an anaemia however only occurs in a very small percentage of the cases Thus in Finland where the inhabitants are said to be more prone to Diphillobothrium anaemia than other races the anaemia rate is only I or 2 per 10 000 infections There is considerable evidence that the role of the worm in the production of anaemia may constitute a trigger mechanism precipitating the anaemia in individuals who have a hereditary or racial tendency to it but who may not suffer from the anaemia in the absence of the Diphyllobothrium infection The fact that alcoholic extracts of the parasite may precipitate permicious anaemia in individuals who have previously had tapeworm anaemia suggests that some constituent of the worm may inhibit or destroy the early pernicious anaemia factor produced by the stomach. How ever in some instances the tape worm anaemia has responded to liver therapy even without removal of the worm as is sometimes seen in ancylostomiasi

Taenia Anaemia (Diphyllohothraim) - There has been much discussion about the role that this parasite plays in the production of severe anaemia. Schauman who studied the question for many years (1894-19 5 m Imland) maintained that the para site causes an anaemia not di tingu shable from pe aucious anaemia, and that the reason that anaemia was not more frequent in cases of infestation was because the majority of indiciduals were refractory toward the agent of the tapeworm which causes anarmia

The work of Birkeland who collected the literature and wrote a monograph on the subject in 1930 (published 1932) is much quoted in the textbooks in recent years study of his monograph shows that more than 35 cases of infections in Americans and Canadians or 24 per cent sho ed anaemia

Slydenhelm thought he could demonstrate in the groundup body of the fish tape worm a substance which had a haemolytic action both in vitro and in vivo

In recent work upon the subject Plots in New York observed one seve e case of anaemia in 5 cases of infestation Cushing and Bacal in Montreal had 6 severe cases of anaemia among 40 of the tape worm Magath at the Mayo Clinic found no coinci dence of permitious anaemia with Diphyllobothis im infection. However, there had been only 12 cases of Dephyllobothroum infection at the Clinic

Wardle Gotschall and Horder (1017) have made a careful study of the infection in dogs A series of normal dogs were first carefully studied and then fed plerocercoids in fish muscle. The dogs were allowed to remain infected from 4 to 13 weeks. A decline in the red blood corpuscles was not evident until about the sixth week of infection. By the thirteenth week the red blood corpuscles had fallen to an average of 3 300 000 The haemoglobin fell in proportion

Mueller (1938) in a study of infection with Diphyllobothrium man sonoides in cats gives evidence of severe anaemia developing in the animals as a result of the infection

Totterman (1939) gave to o patients with a history of anaemia from Diphyllobothrium infection daily by mouth for 2 to 4 weeks 0 3 gram of dried worm or the corresponding dose of an alcoholic extract. In 5 of them the number of red cells fell sharply to as little as a million but the haemoglobin did not fall or did so but slightly Accordingly there was a rise of the color index but immediately on ceasing the administration of tape worm substance the blood condition began to improve returning to normal in a few weeks

When one of those reacting positively became infected with the tape worm there f flowed a deterior i in similar to that obser ed a the experiments. There was no great alterat on in white cells. The residue of the power after extraction with alcohol had no effect on the blood. Of the other 4 p tients a reacted to the worm extract slightly and a not at all. There was no reaction to the worm preparation in species with a normal blood picture and in g with cryptogenetic primionis anaems. Fehapithe the sharp fall in the number of red cells indicated a mechanism of hyperesistivity in cases of infection in which the anaems was of the permicious type it improved rapidly on deworring. As to whether the infection causes snaems the number of cases were too lew from which to draw safe conclusions.

bitvers using the complement firstom reaction has found that antibodies are provoked in the serum of patients who had previously suffered from tape worm sociation to the administration per us of either alcoholic extract of D leatm or of died professed worm. Controls however were negative. Worm antibodies obviously ensued it the burnan organism on immunisation per of and patients who had suffered personally

from Botherocephalus anaemia reacted more readily

Treatment.—For the treatment of the worm, most authors have regarded oleoresin of Aspadium (male lem) (Dryophers filix mas) as the most satisfactory drug (contraindicated in nephritis and pregnancy) (See p. 1472 for details of treatment)

Sandground (1938) has called attention to the fact that there bas been an appreciable number of fatalities following the administration of male fern and that the use of the drug certainly calls for caution. In the study of 38 cases of tape worm infection g of which were due to Diphil lobothroum latum he found that carbon tetrachloride was very efficient In r of 16 cases treated with this drug the usual dose for treatment being 4 cc the parasite was effectively eliminated. In 3 the results could not be followed up, and in t, the patient was unable to retain the drug. He thinks carbon tetrachloride is the most effective remedy for the treatment of tape worm infestations in man However this drug also sometimes causes death and must be employed with caution. The dose for adults should not be over 2-3 cc It is especially contraindicated in cases with ulceration of the small bowel nephritis pregnancy and cases where there is fever and evidence of serum calcium deficiency. Sand ground (1041) has reported 2 cases with coma following its use

In all cases of Dipbyllobothmum infection in which there is anaemia, treatment should be given as for permicious anaemia. The anemia usu

ally responds readily to liver therapy

Prevention and Control — Prevention depends on the careful abstinence from fish which has not been thoroughly cooked. The public should be instructed regarding, the dangers from eating half-cooked fish and cooks should be warned not to taste raw or half cooked fish in connection with flavoring. Bergeer advises that in the endemic regions persons should be warned to cook fish twice as long as they are accustomed to Children should not be allowed in kitchens and in fish markets. Feeding raw fish to dogs and catts should be discouraged.

Diphyllobothrium mansoni (Cobbold 1882) (D erinace Iwika 1933) is an all elboth on the property of the property of the property of the property of the carnivers in Japan Chira Britis Gunan Austrian and East Africa. The parisit seldom attains a length of more than 60 or at most 100 cm. The oral act narries and more ellipsoid than these of D Istam. The normal intermediate holds are (1) a cyclops and (2) either a frog or a weake. A number of human infections with the pleroetroid stage have been propried.

SPARCANOSIS

Spargraum massons (Cabboli, 1881)—The pherocate of larval form of D montons haven as \$4 persists of mass of ma

Spergeams montons in form resembles rabbon like stings of fat 3-12 inches long and may be encouplated in many different tissue on stravely in the conjunctive where there may easier serious of sturbances. The largest number of cases have been reported from Info Chana. China and I pann and perhaps this species has been encountered in the United States. Also statieved cases of closely related larges are known from almost every nair of the world.

Human infection might come from swallowing infected cyclops in contaminated drinking water. There is evidente however that infect tion may be brought about by the Chinese custom of applying split like frogt as a dressing or poultice to sores on the hands or in the vagina or in the eyes the parasite migrating from the frog into the tissues of the wound. Such Spargenium infections give rue to a large amount of eve diseases in some localities which may be serious. Under normal conditions the plerocercoid stage is passed in the frog Roma sugrementalia or a snake Elaphe climaconora and the procercoid in the cyclops C leuckarii.

There is much confusion about the differentials in of the species of the Sp_0 modes group of D Sp_0 balantum a. If of which are primarily when matter p_0 principle of a worst. I assist Campbell and P closes p_0 one described p_0 species in China, but more recently loss is q_0 (q_0) control of this all the mentalenes of the group belong to a night species. D e m at s since be could find in the prophet does of a single worst all of the differences in some T. But the Chineses P systems developely control there are inological differences in some T. But the Chineses P systems developely control of the T should be developed in frogs and the American m and e order faith T so the T should be T of T and T and T and T and T are T and T and T and T are T and T are T and T and T are T and T and T are T and T are T and T and T are T and T and T are T and T and T are T and T are T and T are T and T and T and T are T and T and T are T and T ar

The form described as Sparge am prolifer in (Imma 905 Sultes 1903) as a pletocered the at lorum of a tape worm of which the adult form is inknown: It has been reported in 6 human cases in Japan and in a folderman in Florida. In it e Japanese case I fain of und thousan's 60 the tarvas in the substrateous bissess intermecular fasciae the mesentery walls of the interaction bid eys lungs beart and brain. On inject on it their larvae by verticebases they are directly only insumally permits them to a e.g. I will be a lorum of the substrateous theory of the substrateous to the substrateous to a e.g. I will be a lorum of the substrateous the substrateous the substrateous to a e.g. I will be a lorum of the substrateous the substrateous the substrateous to a e.g. I will be a lorum of the substrateous the substrateous the substrateous the case of the substrateous the substrateous the substrateous the substrateous the degener to forms without acolors of corrience in an undervorable booth (sums) and so for they he could be the found in many contractions of the substrateous threads the sub

A number of other cases of Spargs um infection have been reported in the United States but Chandi r (1940) points out there is no information as to the species to which they belong. However D mansomodes has a wide distribution in cats in the eastern United States and uses wild speces of mice for development of the Sparganism. Multier and Goldstein have above it had when the young Spárganism of this speces are experimentally implanted in human flesh they grow normally. A few case have been reported in which the Sparganism apparently multiples in the body hy end likegrowths. Thousands of worms usually only 3-13 mm in length but sometimes larger may be present in some this modules in the skin.

Pathogementy and Symptoms of Sparganosis —The invaded cutaneous tissues, when they become distended by the developing larvae, frequently become codematous and painful to the touch. When opened, the larvae may frequently be found contracting and elongating but in other instances they are degenerated and sometimes enclosed in caseous masses. More or less local unfiammatory, reaction is encountered.

Ocular sparganosis especially described by Casaux and more recently by others has been encountered, especially in French Indo China and about the Tonquin delta

In years (1930) has observed as asses of sparganum infection of the 19 an Tokko all following positives of the tree leng Rome dismendents: Little the empired about nail cavity or a part of the thag he or even the whole animal is used to make the positive lit thinks this northod of treatment is employed because the fire gas told blooded hence believed able to quench fivey inflammation. He has observed that the parasite may settle in the ids or it may penetrate the orbital list or burney towards the surveit the face the temple the root of the rose or the region of the check. The globe of the 19 are in not penetrated though accountary bacterial infection may Guise it.

The presence of the larva of the non proliferating type in the eye is usually characterized by pain redeass and oedemo of the cyclids with lacrymation and sometimes marked posss. The larvae have been found under the conjunctiva, and nodules frequently form around the parasite in the conjunctival itssues. Invasion of the retrobublar region may give rise to lagophthalmos and ulceration of the cornea. In the cases in which die lesions are confined to the skin due to the proliferating larvae and like pustules may develop and the surrounding issue may become honey combed by the parasites which when they invade the lymph channels may produce oedema and elephantiass.

Mueller (1918) has studied the indection experimentally in animals. He lound that when the parasite is swallowed by various hasts it presents the wall of the inclusive exceles mu cle and continues to grow. It travels for some distance laterally under the pertinenum before pretroing it and thesefore the internal contents do not escars into the pertinenum before pretroing it and thesefore the internal contents do not escars into taxes of the mouse leves and grows for about a week. The frame are made to taxes of the mouse leves and grows for about a week. The frame are planted in the travel does not except a part of the travel due to harrowing and distinctional or. Spargan or subcultaneous issue. If however the monkeys have rectured previously impediately of tayerous bases the indection thanks to an ostimphilias are promptly encapsulated. In various bases the indection thanks to an ostimphilias.

Tremment—Heller reports that he has treated accessfully 20 cases with ocular lettons by intra-coop surjection of non-armonhemol 20 cgms per does for adulting the companion of the contraction of the contr

retrobulbar infection however he found it was sometimes necessary to inject 2-4 cc of 40 per cent ethyl alcobol with novocaine into the lesions to kill the parasite. In other instances, attempts were made to attract the parasite to superficial sites by applied beat.

Prophylans—For the prevention of the infection in endemic areas all dimking water which may possibly contain cyclops should be boiled or acrelluly filtered the public about be educated with reference to the danger of applying split fresh frogs as poultness to inflamed or ulcerated areas of the skin or conjunctiva or other mucous membranes

RARE TAPEWORM INFECTIONS IN MAN

Berhella studen (Blanchard 1891)—Thus parasite was first obtained from an orangoutang in Borneo and has since been found in other primates in Asia Africa and Cuba In the Philippines the dog has been found infected. A number of human cases have been reported in these forables.

A related species B micronolg (Meyer 1895) has been reported as an intestinal parasite of a man living in Cuba who was an immigrant from the Canary Islands. It

bas also been recorded from the African chimpanzee

houn (1910) reported 5 cases of tape worm infection among children in Cuba. The parantie was referred to the grean Resilitation and named Residents. Subsequently a total of a cases were found which seems to substantiate the opinion that the insidence of this species in Cuba is much greater than was hither to suspected. After further study the parantie bab been named Intersactifier carbons. Kours found that the paranties could be explicit early by antibleminte treatment but one instance of a low who paranties could be explicit early by antibleminte treatment but one instance of a low who passed p optitudes for a period of 6 years suggests that it 1 not a transitory or temporary transits.

In addition to this parasite Cram (1928) and Cameron (1929) found a second species of this family ANDPLOCEPHALIDAE probably Best ella studers in this same district in

Cuba and Roy (1938) has reported another case in a boy aged 8 in India Stunkard (1940) has sho in that oribated mites may serve as intermediate bosts of

Bettills and other anoplocephaine tape worms
Africa and Garcia (1935) believe that in the Philippines Beritella is
acquired from monkeys and Kouri thinks that I cubeniss is a natural

parasite of some lower animal possibly the rat. Other species of this genus occur in rodents in Africa.

The presence of parasites of the genus Bertiella in the intestine appar.

ently causes no unfavorable symptoms Mulcocps mulcocps (seek 25%) (Consura cerebralm) —This parasite develops as a Cos trust in the brain of runtiments and causes and in abore 15° Five authenticated cases of Coennius III interest infection in man have been see reled One case of Allet eps mittered cocurred in the brain causing pulpery. The other 4 were found in connective tissue or muscle. One of these was reported as due to M. [Generalett [Millet 16] with grid met influing Raillet and Henry 1913 which had pre onally been found in a genthile and 2 and probably all 3 of the others were due to infection with M series (Coerna 1825) M serialities as parasities as an adult in the intestinal tract of the dog wolf and for As a Coennius it develops in the intransaccials connective tissue of vasious reduction of the control of th

second instance in which Coen use e b dis was found in the brain

Taema taemas formus (Batsch 1 86) is a normal parasite of the 1 testine of the cat

The cat becomes infected from e ting rats harboring the Cy lecterus atage. A single

human case has been reported in a child in Binenos Arres. The infection is regarded.

as accidental and probably resulted from eating an infected rat

they belong. However D measurance has a wide distribution in cats in the estim United States and uses valid species of mice for development of the Sparignoum. Mieller and Goldstein have shows that when the young Sparignoum of this species are expermentally implicated in human flesh they grow normally. A few cases have been reported in which the Sparignous apparently multiplies in the body by end like growths. Thousands of worms usually only y-rs mm in length but sometimes larger may be present in a can the another in the skin.

Pathogenicity and Symptoms of Sparganosis —The invaded cutaneous tissues, when they become distended by the developing larvae, frequently become cedematous and painful to the touch. When opened, the larvae may frequently be found contracting and elongating but in other instances they are degenerated and sometimes enclosed in caseous masses. More or less local inflammatory, reaction is encountered.

Ocular sparganosis especially described by Casaux and more recently by others has been encountered especially in French Indo China and about the Tonoum delta

Joycus (1919) has observed 14 tases of sparganum infection of the eye in Tohia in following poultiess of the tree from Ross Limitacións: Estine the empired abon inal cavity or a part of the things to see the shole animal is used to make the poultie. He thinks this method of testiment is employed because the frog is cold bloded and hence believed able to quench fiery inflammation. He has observed that the parasite may settle in the lids or it may pentiate the orbital fat or burnow towards the surface the face the temple the root of the noise or the repon of the check. The globe of the eye in not pentitated though secondary bacterial infection rang cause it.

The presence of the lara of the non proliferating type in the eye is usually characterized by pain, redness and oedema of the cyclids with lacrymation and sometimes marked piouss. The larvae have been found under the conjunctiva and nodules frequently form around the parasite in the conjunctival tissues. Invasion of the retrobulbar region may give rise to lagophthalmos and ulceration of the cornea. In the cases in which lesions are confined to the skin due to the proliferating larvae are like pustules may develop and the surrounding tissue may become honey combed by the parasites which when they invade the lymph channels may produce oedema and elephantiass.

Mueller (1938) has studied the infection experimentally in animals when the parasite is an allowed by various hosts it penetrates the wall of the intestute reaches muscle and continues to grow. It travels for some distance laterally under the pentioneum before perceng at and therefore the intestual contents do not estapt into the pertoneum leavity. The adult parasite taken from the cat and transplanted not tasses of the mouse have and grows for about 3 weeks. The head transplanted has two processors to the mouse have and grows for about 3 weeks. The head calculation is a substantaneous tissue. If however, the model keys have received previously injection of tapeworm substance the swelling does not occur since the parasites are promptly consputated. In various hosts the infection deads to an econophila.

construent—Haller apprets that he has treated successfully at cases with ocular team by unitaryones superiors of hoverson-board og cops and treated from the construence of the construe

1487 CESTODES

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Diplogonoporus grands (R. Blanchard 1894) a tape worm with a couplet suit of gential origins in each segment is from 1; of 6 netters long and the nature segment are about 2; mm broad and 0; mm long. The own are operulated about 2; hm broad and 0; mm long. The own are operulated about 3; hm how how Infections probably a regured by esting as also which are believed to be the second intermediate host. Normally it is a pursuit of nables: R has been reported in 6 cases of intestinal infection from lipsa 1th symptoms described have been tolkedy passes in the abdomen alternating duribet and constitution progressive secondary anamean increased pulse rate and lassitute The parasites may be expelled by administration of ollorism of appdium or tables.

Digramma Braum (Leon 1907) —Two Rumanian patients have been reported is parasitized by this parasite. Baer regaids it as an immature avian species accidentally

acquired from eating raw fish

Ligula intestinalis (Goeze 1783) has been reported in a Rumanian and a French patient. It is a natural paramite of piscivorous birds. In the first case it was found in the vomitus of the patient. The paramite in the second case was regarded as immuture.

Mesocestoldes Chandler (1942) has reported the first case of human infection with the species of this genus. It conforms closely in most respects with a species recently found by him in raccoons. If variabilis. The child which harbored the words was fretful and anaemie, had poor appetite and complained of abdominal pain.

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Transmitted through Crustaceans—Infections with Dracunculus mediness and Diphyllobothrium latim through the medium of Cyclops and Daragonimasis through certain species of crahs

There are many arthropod which may accidentally bring about direct transference of disease as with tabout or table flies which following contamination of their biting parts with anthrax hacillus blood might directly transfer the virus when shortly after ward feeding on a man or animal or in a similar way transfer the trypanosome of surra mechanically.

Many non biting flies in particular the house fly and possibly cock roaches or other arthropods having access to our food or faeces are impor

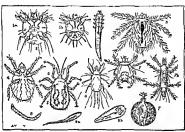


Fig. 350—Arc than 6. has we of tecks (t) S. pt. b. final (th) S. color smale () Dm d x flus (b m (t)) T. mb. 1 k mush the trappolarva (Kada m. tt) (4) Tr mbd um hol s. c. ml I na (Leptus) (9) Dermanys s gall n. (6) Tyolfyth 1 ongor (7) P S sit for read to s. ml. (7h) P. s. y. ung (m. i (7) P senircs s. mpregn t.d.f. ml. (8) A ml fr ml lius (n) L. gus it servated sem 1 (b) L. c. st. at v. Note Egymen to d. trunt to le

tant agents in the spread of typhoid cholera bacillary dysentery and amoebic dysentery

In addition to the importance of arthropods in the transmission of pathogenic organisms to man arthropods themselves may play an important role in producing pathological conditions. Thus the larval stage of the impass producing fless the chigger (sandflea) and the sarcoptic mite may invide the tissues of man and cause important and disturbing lessons. Others as tacks may give rise to paralytic symptoms in some individuals by the injection probably of forms or other secretions. Still others may introduce venoms as certain species of spiders or scorpions or hees giving rise to both local and general symptoms sometimes followed by a condition of shock with fatal results.

Chapter L

ARTHROPODS IN THE TRANSMISSION AND PRODUCTION OF DISEASE

The class Arachaida and the class Insecta belong to the phylum Arthropods. This phylum contains a greater number of species than does any other phylum, in fact it exceeds in this respect all other phylu combined.

Other arthropods are the Mynapods or thousand legged worms and the Crustara to whi h belong the lobsters crab and water fleas—important zoologically but of very slight importance medically. For k-omous Arthropods see page 1538

The different classes of Arthropoda resemble the segmented worms but have as the point of distinction the possession of jointed appendage which proceed from the somites in pairs. Some of the pairs of limba are for locomotion, at times, certain ones may be specialized for food taking

The somites or divisions of the body have a chitinous exoskeleton Respiration takes place through the medium of gills in the Crustacea and by tracheal tubes in the Myriapoda Arachnida, and Insecta

The Arachmida have no antennae whereas the Myriapoda and Insecta have a unglepair of antennae the former having numerous pairs of legs or jointed appendars; whereas the latter have only there pairs of legs. The 'thrhopoda have an expletion which is more or less unyrelding from the deposit of chitin in the cuticle. This cuticle not true skin but only a secretion of the spediers.

Within this external skeleton there is a dorsal digestive system and a ventral nervous system

Great Importance of Arthropods on Medicane—Members of this phylom are important not only because of certain immediate and direct effects of their activities such as the action of poisons introduced by scorpions spideres and ticks or the painful and peace disturbing attacks of various bring arachinds and insects but in vastly greater degree in that among them are our most important transmitting agents of disease. The following is a list of the diseases transmitted by them

Transmitted by trachnids—Rocky Mountain spotted lever tsut sugamushi and other typhus like diseases tick bite fever and the relapsing

fevers of East and West Africa and of Panama

Transmitted by Insects —Typhus fever European and Indian relapsing fevers trench fever American and African trypanosomiasis, plague tularaemia filariasis and lonaasi malaira yellow fever pappatan fever dengue oriental sore and probably other forms of leshimaniasis together with certain belimithte infections (Dephathum and Acantheerphalo)

1483

PATHOLOGICAL CONDITIONS DUE TO ARACHNIDA

TROMBIDIDAE (HARVEST MITES)

These generally have a soft more or less harry metgument and are often brightly colored. The two eyes are often pedunculated and the chelicerae are lancet-shaped and the palps project beyond the rostrum as claw like appendages. A tip like append age on the ap cal segment of the palps is characteristic. A very common and annoying member of this family is the hexagod larva of the Trombic la stone It is in Europe designated Legius a tum its Popularly it is termed harvest mite chieger

Redbugs or Chiggers. - They are found in the fields in the autumn and attack both man and animals They measure 150s and climb up the feet and legs their small size enabling them to enter through ordinary clothing. They do not penetrate the skin but soften the skin with a secretion from the bypopharyny. Serum from the host hardening makes a closed tube through which the larval mite feeds. After becoming engorged (one or two d ys) they drop off and m ult on the ground to become a legged nymphs The adult mutes do not attack man The condition (stehing and redness)
produced is at times called autumn lerythema There is a T ombidium (Trombicula) n Mexico which has a predilection for the skin I the cyclids prepuce and navel

Ewing (ro. 8) divides the trombiculine larvae into 15 different genera. However in most instances the adult mites ar as yet unknown. They have a wide distribution and species afflicting man are found in Australia Japan a d the East Indian Islands southeast Asia Europe and North and South America. As yet apparently they have not been reported from India or Burms or in Africa In some of the East Indies red bugs seem to constitute a m e intolerable plague th n anyw bere else. The red bug dermatitis is probably due to a specific poison secreted by the mites. The inflam mation of the skin may not be felt for 2 or even 24 hours after attachment of the mites When the inflammation does commence there commonly appear large red blotches on the affected parts which sich intensely and are made worse by scratching. After a day or so the red blotches blister and fi ally scab over Sometimes the toxic effects are seen in the ner ous system occasioning arritability and insomnia and not infre quently fever. Newcomers to red bug infested recio 5 may suffer severely the fi st season or two but are said eventually to appear to build up a tolerance or perhaps an immunity. In such individuals, it has been reported that the occasional red bugs which do succeed in attaching themselves although they may cause irritation are said to be unable to eng rge

Morrow (1010) has prepared an antige by granding the chiggers and extracting with distilled water. Ce tain individuals gave a positive skin reaction to this antigen Heat accord to destroy a portion f the autigen so the tit became less irritating and induced less eaction. He believes that the e t eme irritation produced by the bite of the chagger in some 1 dividuals is due to previous sensitize ton of man by some substance introduced into the akin and be thinks it prob hly possible t bring about a reduction

of the linit tion by desensitization with a suitable antigen

Preve tion a d Treatment -- In countries whe e red bugs prevail it is ad isable to aprinkle sulphur on the legs and inside the stock ngs especially for those who have to walk through tall grass or brush where these pests abound A hot bath shortly after nfection with soap and a da added to it often gives much rel ef For the itching weak ammonia or baking gods applied to the affected parts usually gives relief. Subsequently weak solutions of subacrtate of lead or substate of copper are of benefit Cha dier from personal e persence recommends mentholatum rubbed on the hites

Trombicula akamushi is called the Kedani mite and a typhus like disease called tsutsugamush; which occurs in laborers harvesting hemp on the banks of certain Japa nese rivers is tra smitted by it. It is described in connect on with this d sease (p. oze) Other forms f R chell a are transmitted by mites of the genus Trombs ula such as T dels s s in Sumat a a d T & st of Mossman fe er in northern Australia

Bacterial infections of mosquito or other insect wounds by scratching are frequently reported For a list of Arthropodan diseases see p 1558 [Chap LIII]

THE ARACHINIDA

The Arachnida differ from the Insecta in having the head and thorax fused together They also have four pairs of amhulatory appendage whereas the insects have three pairs. The Arachiida never have com-pound eyes—eyes when present being simple. Of the two orders of Arachnida of interest medically the Acarina is far more important than the Linguistulida

ene Dingu	aturua		
	CLASSIFI	CATION OF THE ARACHNIDA	
Order	Family	Genus	Species
	Trombidudae	Trombicula	T akamushi
Acarina	Parasitidae	Dermanyssus Liponyssus	D gallinae L bacoti
	Tyroglyphidae	Tyroglyphus	T fammae T longuor
		(Glyciphagus	G domesticus
	Sarcoptidae	Sarcoptes	S scabies
	Demodicidae	Demodex	D folliculorur
	Tarsonemidae	Pediculordes	P ventricosus
	Argasidae	Argas	A persicus A ministus
		Ornthodorus	O savignyi O monbata
	i	/lxodes	I neinus
	ł	Hyalomma	H acgypticus
	í	Rhipicephalus	R burst
	Ivodidae	Dermacentor	D variabilis D andersoni
		Boophilus	B annulatus
	1	Amblyomma	A hebraeum
	1	Haemaphysaks	H leachs
		(Linguatula	L serrata
Linguatulida Linguatulidae		Armilhfer	A armillatus

ACARINA

Of the acarines the most important are the mites and the ticks acarmes do not show any separation of the abdomen from the cephalo thorax A hexapod larva develops from the egg this is succeeded by an octoped nymph which differs from the adult in not having sexual organs

In addition to the four pairs of legs in the fully developed acarine there are two other paired appendages the chelicerae in front of the mouth and the pedipalps on either side of the mouth

It is zere to find males. Stokes (rigid) stres es the occurrence of various alteria manulentations from sensituation to the protein of the sixth mist. Indication results from the passing of male and female mates or of an impregnated female from an infected to a behilpy individual. Lisually, this occurs by constant and commonly at ingult. As bowever Gerlach has demonstrated the mates may live in day warm int for 3 or 4 days in a reducit that infection may occur from bedding towed; or oth a strategic last conseting the strength of the strategic of the strategic of the strategic last consereption of scales artising from the use of an infected wrectling must in a groundation of a bearing result of the strategic of the strateg

For treatme t it is advisable that there bould be a thorough scrubbing with g een soap and norm water for 15 minutes. Then the patient should take a warm both r may ing in it for 30 minutes at least. This softens the skin especially of the mite burrous. Then there should be rubbed in thoroughly admably with a toothbrush and persistently for so minutes an outment of 5 per cent sulphur in lard The burrows should be esperially scrubbed with the toothbrush and the acars removed or destroyed The patient should go to bed thus anomied. The next morning he should take a both and put on fresh clothing or clothing that has been boiled to kill the eggs or scalies mates. This past course of treatment doe not had the east though it usually kills the adults and immature mites so about 10 days later a second treatment with ointment as before must be carried out in cases as an the field, where it is sometimes impossible to secure the most appropriate treatment outlined application of sulphus outliners or of Ung Hydrag ammon at a d am to the sunce is frequently effective if subbed in thoroughly on several successive days. Blanv skins will develop a sulphur itch if the treatment is applied for too long. Bed clothing and personal clothing must be boiled or baked. A tumbler in the laundry will destroy the mites in blankets and woolen clothing as steam ng or boiling blackets usually rains them

Manson Bahr states that a Dars & preparation kathiolan a special continent con

taining potassium sulphide is used in the British Army

Premises rests upon a sorting conta t with infected individuals and avoiding the u e of infected towals or getting into conta t with infected bed linen

Craw craw —This is a rather chroni papular skin disease which is not uncommon on the west coa to f Africa — These papules may be as large as a small pea and are quite as hard — They are found chiefly on the legs and arms — The protunal lymphatic glands may be enlarged

Undoubtedly many of the user called caw-caw are due to the itch mite. In act on the Mincan expendince of ingo Strapties a down as demonstrated by Bequient and The fer on a number of cases on the scrapings from the skir. Blackbock con Judel that in many parts of West Africa caw caw was us tilly due to this mite. However the name craw-caw has all obviously been applied to other san infection in which committed in the spoons are present. In some presence is now his purpose, the committed is not to the spoons are present. In some parts are so my in purpose, purpose affection in which of the spoons are present in the opinious produce of the backers.

Loewenthal (19 9) pourts out that the condition may have a varied ethology and that its some instances it may be really a form of entlaneous on horierasss. Formerly Of rel reported the presence of a larval fideria in the lessons and Markhe also reported a species of filaria somewhat resembling desauthocksismens persit in:

In cases due to the etch mote treatment should be similar to that already described under scalues. In the papulo postular form there should be desafection of the surfaces with a strong antiseptic followed by compresses of saturated solutions of bone and i lloned by bone and or salural cand on atments in a strength of 5 per cent

Different animals have different species of sich mites. The term mange is suitably applied to infestations of domesticated animals. A serious mange of cast (volectes in) may attack man but the infestation in man quickly dies out for days)

1492 MITES

PARASITIDAE (CHICKEN MITES RED MITES OF POULTRY)

Of the Parasitidae which generally have a hard leathery body and styliners puering chilectes delicate five punted pedipalays and styliners puering chilectes and the Demonstrate Parasition of interest. This mite infests chicken houses and suck at blood of the inmates. In severe indications they may bleed the food to death. They will also attack man. Poultrymen may be troubled with a sort of occasion on the back of the hands and forearms similar to scalues resulting from hist by these mits. The measure 350 × 550s. They have no eyes. The tropical rat mite Liponyius show will state, man and my some of the Southern states of the U.S. has been incommated as a carrier of endemoc typhns. The matter is said to transmit the nicketisal disease to its eggs. These making has placed as demonstrated as a carrier of endemoc typhns. The matter is said to transmit the nicketisal disease to its eggs. These making has placed as demantice.

TYROGLYPHIDAE (CHEESE MITTES)

Grocers Rth — Mites of this family live on cheese flour dired finite tet. They are small without eyes and have a snoods shain and a cone like appearance of the mouth parts which are largely formed by the chelate chelicene. They are cheefy of interest because of their being occasionally found in unite faces etc and being striking objects the question of their pathogenizety arises. The Tyroclyphia longuor has been associated with intestinal trouble (probably a coincidence the patient having eaten cheese cot taining these mites). Other species of Tyroclyphia have been held responsible for vanillistin in those who work with annillation of orfor copraried in coprawaker.

In many parts of the world the dermattis consisting of an itching urticara is known as grocers or batter sitch. The mitter of a species of Glycphagus are found in sugar and are the cause of this grocers itch. Rh. applyshin paraintent is reported to be the cause of an itch like affection of the fect of cooles on tea plantations. Distinguishing points of these 3 mitter are The dorsum and lago if Glycphagus are covered with plumote thats. Tyroglyphus has both claws and suckers on tasts while Rhizesthekin this only class.

Other disturbances due to piggers (sand fleas) are discussed on p 1503

SARCOPTIDAE (ITCH MITES)

Scabies -The itch mites are small eyeless and with a transversely striated cuticle Fig 350 They live on the epidermis of man and various animals. The human itch mite Sarcopies scabies is an oval mite the male is 250 × 150 the female about 400 × 300 Besides the difference in size the male may be distinguished from the female by the fact that the third and fourth pairs of legs in the female have bristles whereas in the male the fourth pair has suckers (ambulacra) In these mites the rostrum is made up chiefly of chelate chelicerae with quite short three jointed rather adherent palpi The female passes through four stages (r) Larva () nymph resem bles adult but has no sexual organs (3) the pubescent female (4) the egg hearing female A female becomes mature in about two weeks The eggs 140µ long hatch out in four to five days A pair of itch mites may produce 1 500 000 descendants in three months The male does not hurrow Copulation takes place on the surface of the skin after which the male dies Scabies is produced by the fertilized female who remains with her host and not by the eggs larvae or pubescent female The adult female burrows into the skin especially between the fingers on the wrists and penis. In infants any part of the hody may be affected These tunnels are from 2 to 12 mm long and tend to zigzag They are dark gray and at the entrance of the burrow the faeces accumu lation makes a sort of minute dirty papule. A vesiculae elevation marks the location of the mite at the blind end Scratching obliterates these hurrow lines They are indistinct in those who bathe frequently (Gale des gens du monde) The tunnels have the egg bearing female at the hind end scattered all along are facces eggs and larvae the eggs heing next to the mother and the more mature young at the entrance to the gallery The mites are more active when the patient a body is warm and relaxed hence the nocturnal itching A diagnosis can be made by demonstrating either eggs or larvae

3 Eyes absent Palps contral Rostrum broad Autornate Harmaphysalis

Eyes present. Palps not control

5

5 Anal groves absent Palpi have sharp transverse ridges Notornate Boophilus Anal groves present distinct

6 Ornate Square to trum Second and third joints of palps as broad as long
Dermacento

Not create Rostrum becagonal dereally Rh prephalas A further description of ticks and their classification is also discussed

in Chapter VII the tropical relapsing levers where species of the genus Ornishodorus have been particularly considered in the transmission of African tick fever

Dermacentor andersons (D remustus) Fig. 228 has been referred to and illustrated in the chapter on the transmiss on of potted fever of the Rocky Yountains. It is a reddish brown tick with a dorsal shield marked by black and a livery, white lines

The male is about z g by z mm. The young female is about 5 by z z mm. when crudet z by g mm. I accurring the neither care of fourist Staters and Ringh Columbia where its the cetar of Rody Monotain spotted fever. If the miss tularizem and is a cause of two paralysis. It appears to be gradually artending its range. The larvae and is jumple with the writing todents as boost but the adult tokes require large mammals or man. The it knowledge the state of the st

D warables the common Jeg c'e of N 116 America is the vector dispotted ferrin the eastern United brates. It also to transmits tultagerium. Other teas which have been abown to convey nicktitual diseases are ambleonmes asymmen in Brais! A subjection Alfrage and Alfrage properties of the properties of

It has been shown that several spories of ticks will harbor the virus of jellow fever lot from 4 to 25 day—and experimental transmission to morkeys has been reported to follow the bits of Drank dor a visibility D—residual D—residual and Amblymana cigens as a 4 to 5 days after vicet in (Aragan 1933)—There is no exidence as yet of transmission by ticks under ratural cond Drank

Tick paralysis is an acute intorication which is caused by the bites of rap dly engorging female ticks of certain species. It ha been observed theily in sheep dogs and occasionally in children. It is most apt to occur if the bite is about the heal or neck. It is characterized by fewer and an acute ascending paralysis (beginning in the legs) which might be confused with poliomyelitis. If the tick is discovered and removed promptly recovery occurs in a few days. If this is not done death may occur irom paralysis of the respiration. It is believed to be caused by a venom secreted by the substancy glands of the tick during the period of rapid egg development. If has been reported chiefly from Oregon and British Columba (where it is cau edy by Dermeestel anderson), and also from portions of Europe. South Africa and Australia where species of Indoor have been incriminated.

1404 TICKS

DEMODICIDAE (HATE FOLLICLE MITES)

Demodex Folliculorum.-Thre is a vermiform acarine about 400µ long living head down chiefly in the sebaceous glands of nose and forehead. The eggs are about 75 X 354 A six legged larva hatches from the egg and develops into an eight legs d adult after four moultings Some of the cases of blackheads are due to this face mite and from 50 to go per cent of human beings have been reported to harbor them (Ger many) Statistics do not show greater frequency of mites in comedones in the U S than in normal glands. They do not seem to cause any ill effects in man, but the come done continues until the mite is expelled. A different species causes a severe mange in dogs

TARSONEMEDAE (LOU E MITE)

This acarine family shows a complete dimorphism. The last two pairs of legs are widely separated from the front legs The Pediculoides sentricosus is oval the male is about 125 X 75µ and has claws at the extremuties of the anterior and posterior pairs of legs the two other pairs have booklets and a sucking disc. The female is about twice as long but of the same breadth as the male and has claus only on the antenor legs The chelicerae are lancet-shaped and retractile. The large pedipalps are lused together antenorly The gravid female is like a ball and is about 1000 in diameter

These putes are viviparous a single female containing from 200 to 300 sexually matur mit s They live on various ensect larvae found on cereals and other plantsparticularly straw and cotton and from handling or sleeping on infested bedding material man may contract a violent dermatitie possibly covering the entire body The eruption with wheals papules and vesicles appears in about 15 hours-marked stehing and burning and sometimes fever

LODOIDEA (TICKS)

The superfamily Ixodoidea is of great importance medically It 15 divided into 2 family groups the ARCASIDAE and the INCOIDAE The former is discussed in Chapter VII (African tick lever)

FAMILY IXODIDAE - Mouth parts project in front of body when viewed dor ally Scutum present Stigmal plates posterior to fourth pair of legs Adults have suckers beneath claws Shin finely striated

Anus behind middle of venter Sexual dimorphism marked

has well developed scutum female has porose areas

Section Ixodeae (Prostriata) - Transverse recurved preanal groove in female Male has ventral surface covered with chitinous plates. No eyes Genus Ixodes

Ixodes has long rostrum with slender palpt-palpt narrow at base leaving gap between them and hypostome No festoons

I ricinus is the intermediate host of Babesia bour the cause of cattle fever of

Europe This and other species may cause tick paralysis Section Rhoquephalae (Metastriata) - Anal grooves behind the anus or absent in the female Ventral surface of male without adanal plates (in Dermacenter Hoemaphysolis Aponomma and Amblyomma; or with one or two pairs (in Hyalommo Rhipicephalus and

Bonokilus) Marginal festoons present, more distinct in the males The more important genera can be distinguished as follows

Palm long and slender Palps short

2 Segments of palps equal in length Eyes present

Second palpal segment much the longer 4 Very ornate Eyes present

Not ornate Eyes absent

Aconomiso

long the female vellowish to cm lon and has about go annular segments The eggs are thick walled contain a developed embryo and are enclosed in a thin walled bladder like structure containing fluid. These are discharged with the nasal secretions When ingested by a suitable intermediate host usually a herb vore occasionally man a minute (754) four legged larva is liberated This penetrate through the gut wall and reaches usually the liver of mesculenc glands where it develops moulting several times and finally (after 6 months) encysts as a nymph This is about 5 mm long and resembles the adults except that there is a row of minute somes on the posterior margin of each ring. When the intermediate host is eaten the nymphs make their way to the sanuses and develop into adults

The parasite is widely distributed but nowhere abundant. Human infection with adult parasites is very rare but infection with the lar ac is not uncommon in parts of Europe D agnosis intravitum is rarely possible. Little is known as to symptomatolo=y

Armilifer armillatus is a paras to living in the trackes and lungs of nythons and other Af ican snakes Other species are found on the surface of the ler sometimes encysted The mal s are 3 to 5 cm long with about 16 1 gs the female 3 to 12 cm lon with about 20 rings. The eggs (80 to 100µ) to t n a de eloped larva. They a e passed with the bronchial ecretions of the snakes and are ingested with contami ted fo d o water by monkeys occasionally by various hersibo es or by man. The lar ae penetrate into the liver or other o gans under o a pr tracted period of de elopment (z to a years) and finally encyst (nymph) When the intermediate host 1 eaten by a snake the nymphs a e libe ated and p netrate into the lungs i he e they develop rapidly into adult forms. Many cases i human infection have been epo ted from west Af ice espec ally the Belgian Congo A few c ses f human infe tion ha e been reported from the Orient (with A oniliformis) and two cases from America (possibly with Poroc okalu cratal: of rattle snakes)

It has been suggested that human infestations were probably acquired from ingesting raw infected snakes. However this seems somewhat improbable Moreover Van den Berghe (1938) in experimental infec tions in animals has shown that man is probably infected by drinking water containing the ova deposited from either the sputum or excreta of the snake. In water the ova showed considerable resistance. The envelope of the egg does not become digested in the gastric juice but in the duodenal juice The larvae then penetrate the intestinal wall and the layers of the peritoneum and enter either the thoracic or abdominal organs as the lungs and liver

THE INSECTS IN RELATION TO DISEASE

Insecta

The class Insecta has one pair of antennae three pairs of mouth parts (the fused labium being considered as one pair) and three pairs of legs They have three divisions of the body-head thorax and abdomen

The head carries the antennae and mouth parts the thorax which is divided into the prothorax mesothorax and metathorax carnes upon the ventral surface of each thoracic segment a pair of legs and on the dorsal surfaces of the two posterior segments a pair of wings The abdomen d es not support appendages. The air is supplied by means of tracheae—branching breathing tubes which have external openings or st gmata The tracheae are stiffened by sp 1 chitmous bands. The Malp ghian tubules are excreto y org us of the alimentary system and e crete nitrogenous waste material Insects have two pairs of wings the second par of which is frequently rudimentary and shows simply as knob like projections These are termed halteres or balancers In some insects both pairs of wings are rudimentary as in S phonaptera

Barnett (1937) Gibbes (1938) and Mail (1939) have reported with reference to wood tick paralysis in the United States due especially to Dermacentor andersons: In one case reported by Robinon and Carroll (1938) from Georgia and one by Beach and Ravenel (1941) in South Carolina the tick was D tarnoblist. In British Columbia it is said some 150 cases many of them fatal air reported every year.

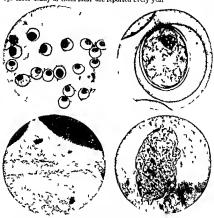


Fig 300 - Development of Poro ephol s (Afte van den Bergh)

I Ova in the pulmonary mu us of Bos const sclor
2 The ovum more strongly magnified

3 To the I than below two larvae of Po oceph lus lovetus liv g between the folds of the mesent ry in an experimentally infect d rat 6 days after ingestion of the ova 4. One of the larv e mo e h ghly mangified.

LINGUATULIDA (PENTASTOMIDA) (THE TONGUE WORMS)

These are degenerate worm like arthropods formerly classified with the Arachaida although they are not closely related to any other group. The adults have clongasted annulated bodies. They have two parts of related the mouth hooks. Otherwise there are no traces of legs antennae or palps in the adults. The species of nedical interest are included in the family Linguistahodae (longuist terrors).

Linguatula serrata Fig. 359 (L. rh narie) in the adult stage is usually a parasite of dogs or other carnivores (rarely of man) occurring in the nose or paranasal sinuses where it causes severe thronic inflammation and bleeding. The male is white 2 cm.

Pediculidae

In this family there are no wings and there is no metamorphosis They have simple eyes and 5 joints to the antennae The legs are well developed and terminate in powerful claws The young resemble the adults The ovoidal operculate eggs (mits) are deposited on hairs or clothing of the host

Pediculus Humanus Var Corporis (P ve timent) F gs 2 o and 361 - This louse hves about the neck and trunk underclothing being rately found on the skin. The louse feeds about twice a day deprivation of food causes the death of the adult in o days and the newly hatched louse in two days

Pediculus Humanus Var Capitis -The eggs usually 60 in number are deposited on the bairs of the head the favorite region being back of the ears They hatch out in 6 d 35 The lice larvae on emergence closely resemble the adult and beg n to feed shortly after h tching They moult

about every 3 days and become adults within 10 day These organisms have been discussed and described in the

chapters on Typhus and Relapsing fevers

The body louse (and probably the head louse) has been shown to transmit epidemic typhus fever and trench fever Mackie (in India) and Nicolle (in northern Africa) showed that it is a vector of some strains of relapsing fever (in Europe India China northern Africa and North America) Whereas the louse can transmit typhus and trench fever by biting the spirochaetes are introduced only by scratching and rubbing the infective hody fluids of the louse into the wound Typhus and trench fever are usually intro duced in the same way either the crushed body of the louse or especially the faeces being infectious These viruses apparently undergo some developmental cycle



in the louse since the louse is mcapable of transmitting these diseases until several days have elapsed after the infecting feeding typhus fever 8 to 10 days (the faeces may be infectious after , or 4 days) relapsing fever 4 days trench fever facces infective after 7 days

Phthurus Pubis - This I use is nonularly known as the trab louse. The female is I ttle more than 1/25 inch in length and the male a trifle less They are almost square The second and third par of legs are supplied with formidable hooks. They have a preference for the white race and live about the pubic region The female lays about a do en eggs which b teh out in about a week. It is not known to be a vector of any inf ction

The at louse Polyplan spinulosus is important as a vector of endemic typhus among rats The rabbit louse Hae sod ps s venirscorus was shown by Francis to be a vector of tularaemia among rabb to The dog louse (Trickedecter ca s) is one intermediate host of D bylidium

HEMIPTERA (RHYNCHOTA)

The Hemiptera or bugs are insects possessing mouth parts modified for sucking in which the lower hip or labium or heal, having a to a see

	CLASSIPICA	310'V OF 1	THE CLASS INSECTA	
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Hem pt sa	& made		C. rotundatu	
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When injects show instamorphous soraness worm his larver batch from \$25 the livrar are succeeded by a quescent non feeding encased pury which finally develops into an image on fully developed insect. An inject which does not present this developmental cycle shows incomplete metamorphous. Of the class insects only the Anoplars I limper any phosphagater and Dipertiar are of special importance.

ANOPLURA (SIPHUNCULATA)

These are small dorso-ventrally flattened wingless insects not showing metamorphosis

Pediculidae

In this family there are no wings and there is no metamorphosis They have simple eyes and 5 joints to the antennae The legs are well developed and terminate in powerful claws. The young resemble the adults. The ovoidal operculate eggs (nits) are deposited on hairs or clothing of the host

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The rat louse Polyplax spinulosus is important as a vector of end mic typhus among rats The rabbil louse Haemod p s nir c s was shown by Francis to be a vector of tularaemia amo g rabb is The dog louse (Trichodectes can) is one intermediate host of Dapyled um

HEMIPTERA (RHYNCHOTA)

The Hemiptera or bugs are insects possessing mouth parts modified for sucking in which the lower hip or labium or beak having 3 to 4 seg

I SOO HEMBTERA

ments has its edges curved to form a groove. Within this groove are the bitting parts—the bristle like mandables and marallace

The former are double grooved on their internal surfaces and thus when apposed form two tables one for injection of salvas and the other for suction of just of blood. The manifest support the mandelles. When so repose the beak or rostrum a best back under the head or thora: The beak is covered by the labrum only at its back this officers in the Dipters in which the bloom goes not formation of the surface produced to the surface of the su

Bugs have no palps. They have two pairs of usings which in some genera bowever are rudimentary. The metamorphosis in this order is incomplete.

Comicidae

These have a flattened body a three jointed rostrum, and four jointed antennae Their wings are atrophied

Comer Lectularus (Acastina Ictiliana) (Fig. 2, p. 300)—This is the cosmopolius bething or claim. It in resures about 15 by 15; inch (5 by 3 min.) It is brownshire in color. The most conspicuous feature of the bething is the long proboses continuing the the color of
Cimex Rohandahis (I refundeds)—In India the C refundeds is the one corona tered. It is dark makingany in color has a smaller head carrower abdomen to counsel protocoare borders and is more densely covered with bairs than C legislatus Related species of bugs parasitic on other anemals particularly least and bela occasionally attack man but they rarely establish themselves in human habitation

Relation to Discoss — The bedbug has been suspected of being a transmitter of many different infections but there is no convincing evidence that it plays a really important part in the natural transmission of any of them. Francis showed that it is readily infected with P lutarensis and transmits the infection by hitting (mace). It can be infected with plague bacilli and animals can be infected by rubbing the crushed bug or tes facces into the slun but not by a bite. The same appears to be true of Borralia recurrents. Leptospris sitere hoemershague and Trypanisma cru : It probably plays no part in the spread of typhus lever or Lesh manus infections. The ordinary pathogenic bacteria do not multiply in the hug because of the bactericidal action of the contents of its digestive tract.

Reduvudas

These hemiptera are popularly known as assassin bugs corsairs or kissing bugs.

They have a long narrow head and a distinct neck. They are vigorous there and run

ners The majority are predictions feeding on other intects but if disturbed may induct very parifield bits on man A. few have become blood socking parasites and are of great medical importance because several species are hosts of the South American typinotome T e u. The parasite undergoes a regular cycle of development in the hear and is transmuted by it. [See section on Trypinotomicals 3]. These species are host and an armonical section of the section of the proposition of the properties of the proposition of the properties of

Trainous megista (C. norfinus neg. plan) (Figs. 48 %, no pp. ni k. gog.)) is the important vector in Brail R is cited barbens because of its preference for bring the face. It shi clk with red markings on the wangs abdomen and prothors. The anten nace for this ground are marted makeay between the eyes and the post of the head The hugs live in the native buts hading in cracks during the day and feeding on the interest right. It has had it we the those of the bod lang. The wingless laviave (which is made and the state of
the coprophagous habits of the larvae

Trialous I festour replaces the p ecoding species as a vector from southern Brazil southward and westward through Chair Boluva and Aspentina. Other species naturally infected include T for shessin T dissipated T g sizulato T brownes and T oroidal Rhodnuss proliusu (and R p chipa') replaces Trialous as the principal vector in orithem South America. It is shown with yellows the mixings. The antennae in this

northern South America It is brown with yellowish markings. The antennae in the genus are inserted near the extremity of the bead

Several species occur in the southwestern United States including

Tratoms sangurunga (Covo k nus conquiruque) the Texas or Mencan bedbug it sometimes preys on and obtas 1 su blood from the common hedbug (C mez) and prinsps thus having acquired a taste for human blood it now attacks man. It is nearly an inch long datk brown in color with a long flat narrow head and a short thick rostrum Its spreading northward. It has been infected with T c = v experimentally

SPHONAPTERA

The fleas are laterally flattened markedly chitmized wingless insects which undergo a complete metamorphosis. The classification of the Siphonaptera and the importance of the Pulicipae in the transmission of disease has already been diseased in Chapter VVIII (Plague).

As a result of the convuncing experiments of the Indian Plague Commission the role of feas in the transmission of plague was absolutely established. It is by the bits of Aenopsylla cheeps; that plague is chiefly transmitted from rat to rat and in bubone and septicement plague it is apparently the intermediary in human infection. However any species of flea which lives on the rat is capable of transmitting plague as would also Pulce virtuans if fed on the blood of a human care of septicacinc plague.

Trypanatoma lears (and possibly other rodunt trypanatomes) also are transmitted by fleas either Pales triftons or Clemosphalius cons: The trypanasome undergoes development in the flea. the infecting material is in the faces of the flea and transmission may occur by the licking on the part of the rat of faces from an infected flea. The infection has no constraint of the rat of faces from an infected flea.

nection with the puncture wound of the flea as is the case with plague.

The rat fleas (\(\ldot\) cheops and \(C\) fascalus\) also serve as vectors of endemic typhus (Rickellita mooseri) conveying the organisms from rat to rat and rat to man (See Chapter YLV) Fleas may convey tulis raemia.

1502 FLEAS

from rodent to rodent but are not known to have infected man. The evidence at present indicates that they are not concerned with the transmission of the trypanosome diseases of man or the larger mammals or of Leishmania.

TUNGIDAE

In the TUNGIDAE family of fleas the abdomen of the female becomes enormously distended with eggs and she remains fixed in the burrow she has made under the skin whereas in all other families the female remains practically unchanged with freedom of movement after fecundation

Tunga penetrans (Dermatophilus penetrans) the jugger chigor nigua (of South America) or sandilea is of great importance in a number of tropical foundatives Originally found in tropical America it was said to have been introduced into Africa in sand ballast in 1872. It spread rapidly over nearly the whole of Africa. However the affection has apparently not yet established itself in India or in Europe although a closely related species. Teacrigens has been found on the cats of rate in Shanghai.

The male and virgin female are relatively unimportant as they do not protestive the skin but act as ordinary fleas. The female which when unimpregnated is not about 164 anch long when impregnated bores its way into the skin of man repenally about the teer solet of the feet of finger nails and in the chosen site develope and mostly becoming as large as a small pea. This collegement takes place in the second and third abdominal segments which are packed with eggs measuring about too long and numbering about too. Clinically a small black spot in the center of a tente raise can be differentiated by the proportionately larger head and capacilly by the fact that the head has the shape of the head of a shift distinctly institute that the state head of the feat of the first the lower border of the head of a shift distinctly institute the recommendation of the state of the feat of the first place. The first place is the lower border of the head comes out in a straight line to join the curve of the upper and. In the Tings lower and upper border of head are shoth curved.

Man and pigs seem to be the principal hosts but cats dogs and rats are al oafferted

The wounds made by the burrowing female in the skin may become much inflamed and very painful. Frequently the distended abdomen of the fiet is crushed and the eggs released in the wound and in such cases marked inflammation may occur unless the crushed body and eggs are mediately expelled. When the eggs are laid in the skin the tissues around them ulcerate and pus is formed. In this way, the contracted female flet is expelled. The lesson which is fit is very hable to infection by bacteria and this has sometimes resulted in the loss of toes or larger parts of the limbs through flood poisoning. In Central America darget parts of the limbs through flood poisoning. In Central America darget is the contracted of the properties of the contracted in Costa Rica at 4 years from infection of Nigus (sand fiea) wounds. While sometimes only a few fless are present at the time there are cases in which hundreds infect a person at once. Then the skin may become honey combed and the foot or other parts of the body become so sore that the patient is remporarily incapacitated.

The treatment formerly recommended was the destruction of the fieas while imbedded in the wounds by applying insecticides the dead insect being later removed after ulceration often with the needle. It is now recommended that the entrance hole of the fiea be test enlarged with a

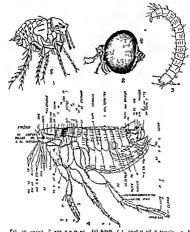


Fig. 30 ~6-2 I ngs p a n nr (x) Adult () gg-d at uit d temale 3 Fl lar a hghly magn 6 d (x) fleed (x) and none (y) egg dr 2k (4) caud l styl t (F m Byum and A ch b 14) 4 Ext mal sant up f a flee (Afr Fox)

clean needle and the parasite removed entirely. Then the wound should be cleansed with an anti-eptic solution and dressed with an anti-eptic outment.

Quiros in Central America has emplyed 232 grams of sal cybe acid and to grams of inhibyod in to grams of wasel in: Thanke withed into the late every 3 days especially a terbaing and expells newly attached fless and prevents fresh infections. For prevention through rubbing of the floot every war 3 days with waseline 3.5% or and fig.

1504 FLEAS



FIG 363 - Camera fucada drawing of section through lesions on tax ing Tunga (D : matophilus) penetrane (A Hamilton Rue-Harvard Amaton Report)



PIG 364



1'10 365

Fig 364 - Sand fies female much enlarged
Fig 365 - Sand fies female Shortly sites penetrating the skin. The enterior part of the abdomen as much mo e distended than the posterior the enl rged part is d sk shaped not globular (From Mense)



S ction greatly enlarged Pto 366-Sand flea m sole of f ot

drops of lysol or cresol scap has been employed. Infecting can be avoided to a great extent by the use of high hoots or hors and leggings. In Central America Quiros recommended that the driving of hog. affected with juggers through the streets should be problisted together with regulations for treatment of the affected hogs. The strictivith figs. Exhibitophylar gail ancess is classified in another family

ECHOPOPARADDE. It is a sin II dark colored flea which commonly attacks chickens in tropical and subtropical countries includ ag the southern United States. However while the normal host is the chicken other poultry dogs cats rahhits rats and other animals hes des man are attacked. In human beings it can easily he found and removed

as it is not as active as the Tunga flea,

Present on —Stret cleanliness in pirvate bouses or public but dings prevents fleas from breeding in them. Dusty careful uncared for exprets et durants accellent hreeding ground for the human fiea. An infested bouse can be rid of fleas except the eggs by spinkling the floors with applicablese and closing up the rooms every ingkt or it is except to the property of the control of t

DIPTERA

The insect of the order Diptera are of great importance medically either because of the direct irritation of their bites because of their trans mitting disease directly, as does the common house fly typhoid fever or because of acting as intermediate or definitive hosts for various parasites. They are characterized by mouth parts formed for puncturing sucking or licking. They present a complete metamorphosis larva pupa and imago. As a rule the Diptera have one pair of functional wings the second pair being modified into halters.

The antience portion of the head which is below the ongs; of the antennae is the face and on next, and of the face or seen the checks when should be studied as to presence or abundance of harrs. The antennae which separate the front from the face are of great importance in classification. In the Mucacida the apparame of a feather structure projecting from the terminal segment of the antennae and called the a side and the face of the face of the second projection of t

The males of fires in which the two compound eyes come togethe shove the antennae are referred to as a loptic if more or less widely separated as dichoptic. Ocella are single eyes usually three: number and when p esent situated in the triangular space between the compound eyes in the from the compound eyes.

In studying the luting dies it is very impo t at to recognize the autenor small or mud-cross venu is the wings. This short transverse nho even in the key to wing venu from leneath it is the d scal cell and t bounds the first poste or cell internally or basilly. The fourth longitudinal even which touches the hottom of the mid cross venu is of particular import nor as it gives different shapes to the first posterior cell as it runs along the lower border of the cell. The cho do in do scal cell is b to we fourth longitudinal to the distribution of the bit is basile to the distribution of the distributi

CLASSIFICATION OF DIPTERA

I Suborder Orth in pha The larvae bave a well-differentiated head. Pupa naked Imago escapes from the pupal case through a T shaped hreak on the dissum near the anterior end. No frontal lumile. Wing venation simple.

1506 DIPTERA

- a Series 1 Nematocera Midge like insects with long many jointed (8 to 16) antennae and usually long slender palpi of one to five segments. Anal cell not narrowed toward the wange margine.
 - or Marginal vein not continued beyond the tip of the wing
 - r Simuludae (Bullalo gnats black flies) Antennae shorter than the thorax with 11 segments not plumose. Wings broad without scales or
 - 2 Chronomidae (Midges) Antennae longer than the thorax bushy with 14 segments Wings narrower median vein forked. Wings bear setse no scafes.
 - β Marginal vein extends entirely around the using Second and fourth longtudinal veins forked

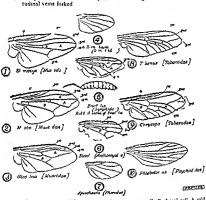


Fig. 367—It ng venation of D pt ra. A I rat poste or cell B d scal cell b mid c oss ven d auxil ary ve n C marginal cell D submarginal c ll

3 Psychodidae (Moth midges sand flies) Wings and body thickly covered with coarse hairs. Wings ovate or pointed

4 Culicidae (Mosquitoes) Without these characters Wings with rounded tips Posterior margin and veins of wings fringed with scales Mouth

parts long slender adapted for biting

Senies 2 Enchytera. The antennae are about composed of only two or three
simple joints with or authors a style or and to the palps are nearly always short
and never more than two jointed. Anal cell closed or narrowed toward the
margin of the wing.

Tabanidae (Horse files) Third joint of autennae complex Costal vein sur rounds the wing

II Saborder Cyclorrhapha. Head of larvae not differentiated. Pupa enclosed in last hand skin. Image excepts through an antenor crucials opening in the puparum pathed open by the pulmum. (This is an inflatable organ projecting just above the root of the antennae and is retracted as soon as the image escape; leaving behand type all scars the frontal londe and the frontal or pulmal suture) (see Fig. 568). Where yearshow more complex:

a Series r Aschiza Philipura small front I suta e absent

Family Syrphidae (Hover thes) Anal cell ends in an acute a gie reaching nearly to the wing margin A spurious wern between the thi d and fourth longit dinal veins. (Mostly large brightly colored dies: A few cases of human intestinal mysass have been reported due to the rat tailed larvae of Eustalis') Se its 2 Schropobora Philumu large frontal suture and lumile marking.

6 Se ies 2 Schizophora Ptihnum large frontal suture and lunule marke causing retraction of front of head. Head freely movable

or Pup para

Family Hippohonoids. Blood usclung cotoparasites of birds and mammals with tough leathery bodies more of less developed ungs and indistinctly segmented abdoness. The larvae are completely developed at birth (A few spicessar vectos) of discoses e g. Melophonoid emourts that the conveys sheep trypaneoomassis and Lymchiz meutres the definitive boat of Human-prietins selambes of pigeons. None are known to convey human control of Human-prietins selambes of pigeons. When are known to convey human the selambes of the selambes o

infection)
β Myodaria Without these characters

Acalypterate myodana have no scales covering the halteres

Oscinidae (Chloropidae) the eye flies

(Also includes the cheese fly Proph is cases and other small flies chefly of minor medical interest.)

on minor mentati interest. Callypterate Myodaria have large scales (squamae) covering and concealing the halteres (Includes a very large number of spec s many of great medical

importance)
r Oestridae (Bot files) Mouth opening small mouth parts rudimentary

2 Sarcophag dae (Fiesh files) Mouth parts normal adapted for sucking Arista of antennae plumose on proximal half only Hypopleural hristles

present
3 Muscidae (Large family) Mouth parts adapted for sucking or biting
Arists of anten ac plumose to the up

Tabagudae

This is may include the der files horselles gaddles breeze files or green headed files. It is one of the most is merous lamilies of the Diptera—there being nearly 1500 species. The females are mostly blood suckers the males live on flowers and plant juices. The cyes are usually by gevery buildant in color and in the male make up the greater part of the head.

They bell ng to the suborder Orthorrhapha and in the group of short autennae flies (Brackycra). The wings are large and enci cled by the costal vein. The third lo git udinal vein is forked. The fourth longitudinal ve. is forked. The fourth longitudinal ve. is breaks up three times thus enclosing the disc l cell. I ve posterior c lis are always prese t. The squ mae are la ge.

The antenna consist of the esegments the third of which is compound. No arists. The mouth parts are complete in the femile. The epipharymis is the like the they popharym has a gion e and both r and shaped. The parted maniha are stricted and the mad the 1 cet like. They has e rather case see mailty pulps The Inhelian reproduced to the third they have represented the proposed to the strong to the flexibility of the flexibility of the male the mandables are attrophed. The Thandadae are think set if e and rarely above 1 for The body of the matter than the second of the seco

Tabanus.— No occili No spurs at t ps of bind tibiae The last (third) antennal segme t is composed of five p rts and shows a crescentic notch Wings clear or smoky

1506 DIPTERA

- Nematocera Midge bke insects with long many jointed [3 to 16] antennae and usually long slender palps of one to five segments Anal cell not narrowed toward the wing marein
 - a Marginal vein not continued beyond the tip of the wing
 - 1 Simuladae (Buffalo gnats black flies) Antennae shorter than the thorax, with it segments not plumose. Uings broad without scales of hairs
 - 2 Chironomidae (Midges) Antennae longer than the thorax bushy with 14 segments Wings narrower median vein forked. Wings bear setae no scales
 - B Marginal vein extends entirely around the ming Second and fourth longi tudinal veins forLed

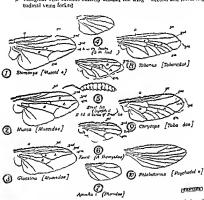


Fig. 367—Thing w nation of D ptera. A First posterior cell B disc le il b md c oss ve n s auviliary w in C marginal cell D subma g nal cell

3 Psychodidae (Moth midges sand flies) Wings and body thickly covered with coarse hairs Wings ovate or pointed

4 Cuhcidae (Mosquitoes) Without these characters \ 1025 with rounded tips Posterior margin and seins of wings fringed with scales Mouth

parts long slender adapted for biting b Series 2 Brachycera The antennae are short composed of only two or three simple joints with or without a style or arista. The paips are nearly always short and never more than two jointed Anal cell closed or narrowed toward the marein of the wing

Tabanidae (Horse flies) Third joint of antennae complex Costal vein sur rounds the wing

Many species of tabands may act as mechanical convevors of infection although the organisms do not develop or multiply in the fly. This has been proved in the case of anthrax e.g. and is of practical importance in numerous trypaosome intections including T erosis T brince T equi mam and T equipardum II is essential that the first feeding of the fly



Fig 369 -- Chrys ps diss is showing the hacter to non p gmontel discal cell
when de ved to nam

on an infected animal be interrupted and that the fly bite a second animal within about ten minutes

Chrysops discales the western deer fly was shown hy France, and Mayne (1921) to convey Pasteurella sularensis (in this way) both to man and animals though the fly may remain infective for at least two weeks



Fic 370 ~C mm n house fly (W ca dom see) Pup wm tift adultnext i a a d ni g d g rts at cight All enlarged (Fr m curular 71 (by L O Howa d) flur au f Entomol gy U S Drawthn to Agraeds re)

Oscardae

The eye files which belong to the acalypterate Myodana are small bailess files about 2 mm l ng. They usually occur in swarms and cause annoyance by flying into

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not spotted do not overlap A large genus (over 2000 species) world note in distribution chiefly large powerful flares which bute viciously both mas and annula T flaucops is the intermediate host of Tryptomeones theires, a non pathogenic parisite of cattle (Europe) Tabanus's are suspected of being the vector of Leishmania in the forested regions of southern Brand and Parisers.

Haematopota —There is no crescenic antennal notch and the third antennal segment is composed of four parts. The wings overlap and show scrill the marking. The abdomen is narrower than in Tahanus No ocells. Commos in Africa and the Orient. The brimp one of the Haematopota bites man severely.

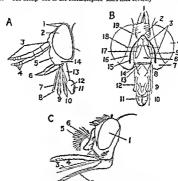


Fig 368—Heads of fires (semidiagrammatic)

A Chrysops disc lis (2) Ocells (2) compound eye (3) antennae (4) annuli

(S) clypeus (6) palps (7) labrum ep pharyas (8) hypopharyas (9) mandibles (10) matiliae (11) peudotracheal membrane (12) labellae (13) lab um (14) geus (8, Myrod das 6, 4, 10) Cell (21) hende (1) of and labrum (14) geus

B Musco d as f.j. (1) Ocell (2) Insulas (3) pid nai nuture (4) compound or 3 (5) antennal groves (6) clypeus (7) genae or cheeks (8) routure (9) ha stellom (10) labella (17) pendotracheal membrane (12) pale (7) pintoma (14) oral who as (15) factalia (16) parafac als (17) antennae (18) arsta (19) parafrontais (Ajier For)

C Gloss na sp. (1) Eye (2) lab um (3) labrum (4) palp (5) arista (6) antenn Paugonnus is characterized by a very long slender and more or less horizonta

proboscis The antennae are small The third segment is composed of 7 or 8 parts Wings clear or smoky

Numbers of the three coells. The extenses are especially long and slend r and have three segments the list one of which is composed of five parts. The wangs are wider segmented and have a durk band along the anterior marga and a broad dark cross band one thard removed from the tip. They milet passion lister. There are many species distributed throughout the world.

6. danalisate and C. sileces serve as intermediate hosts of Lee for (toppered Afrens).

The larval stage lasts 7 to 10 days and then the larns shrinks but remains sur rounded by its old sine lierned opparame which forms the overange for the hards shaped pupal stage. This lasts about 3 days when the adult fly emerges. This is termed a concente pupa. This lays is neargable of buting the purering organs being found the since as laces to the flood about to be inspected. Their ridge in typhoid few is on of importance. By reason of its hury sticky legs habits of frequent defection and constant regregatation of the contents of the cosponalerus the houself was an important agent in the spread of dynentery cholera infautile diarrhoess and tropical ophibil mass as well as typhood.

Auchmeromyta Luteola —It is found throughout tropical Africa south of the Sahara Desert — Distribution coincides with that of the negro and the Bantu races — It does not occur in countries inhabited by Arabs and Berbers

The larve of this African fly the Congo door maggot is a blood-sucker. The larve is about two three of an anchong and has a dirty white thick latchery winklife sixe otherwise resembling that of M demention. The adult for resembles the slow by that y spillows librown. The dy deposits her eggs by preference an dry dust in cracked in the floor of the native buts. The larvae hatch in a few days and seek blood within a few hour extralage out at night to feed on the sleeping natives. They are said to survive for a month without food. This is the only known instance of a blood sixting intrave mides the states man. (Other species of his dos sixting larvae infect the nests of hirds and the burrows of certain manmals). Its attacks may be avoided at night by sleeping no closs lew unders above the floor.

Caliphora vomatorus (with a black bacca and reddt h b ard) and C explore spholo (with a brownish bacca and a black beard) are the common blow flues or blue hottle files. They are large bloated dier a bout one hall ned long with red eyes and are blussh with a slight metallic lister. The checks are barry. They are maily deposit own on e posed dood or decaying animal or vectoble matter of any kin il and on open wounds or ulcers.

of animals and occasionally of man

Lucula assess the common green bottle fly as a maller by of sharp met the green color with a himst hange. The clotest are base it hashts are like those of Calliphore if food contamonated we harvase of these flies is cause they may continue developman in the latestime and case more of elses marked destructances (insteading mysusa). In wounds or alters these flies prefer necrosic disnotegrating times had if this is not ade vyllow palpy also more actively para the frequently starking sheep, on which it instinctions and even fall lingury. It may also attack man and many cases have been observed in China. The fairware of both specess (and sho of Per as are pas to the wood magnot or black blow 5p) have been used extens they in the treatment of outcomychist (far. 1931) although all are explained of impring healthy it use. Stream (1934) has particularly showe that the species Level a serior which has adely been used a a funcion that the species Level a remore which has a safely been used a strong through the serior of the stream o

Cordydonia anthropophagas (loke sepine ands opephag.) the Tumbu fly or African Six Margeor—These as a African Spine has learn Area (they under the skin nof man and animals. It is known as the Ver du Cayor. The own are deposited in dry and occas anomaly on odithon not understood the skin. After 30 or 4 days the three emerges and by means of its mouth hooks attaches stead (saithan y to r4 days) to the skin of the rese amil selds but it comers in constant most often at not or a pappy or quite free free amil with but it to comer a constant most often at not or a pappy or quite free free amil with but it comers in constant most often at not or a pappy or quite free free amil with but it comers and producers a lesson like a both which he as or trade particular happed and best with small spone. At muturity (i. 10 to 4 days) when it is about half as not hong it leaves the body and pupates in the bod. Repeated infections result in an immunity (Lugely) local to the taxin's which the bod. Repeated infections result in an immunity (Lugely) local to the taxin's which

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the eyes or ears or crawling over open woods or ulcers to lap up secretions. The absilts are smilled to those of the house fly including that of requiration the contents of the oesophageal diverticulum while feeding (womit drop). Hispelales pain (in California and elsewhere) has been shown to spread pink eye and other inflections forms of conjunctivities in this way. Kruism and Turner (1916) in Januace have demonstrated that II pullipse after feeding on open jaws ulcers contains many moule spirochaetes in the oesophagus for several hours and they have produced yaws lesions in rabbits by allowing infected files to feed on open skin wounds.

Muscoidea

Under this heading we may group the Muscidae, Sarcophagidae and Oestridae which are callypterate Schizophora

Muscidae

In the Muscidae the antennae hang down in front of the head in three segments and have an ansta plannese to the tip on one or both sides. The first posterior cell is natrowed due to bending up of 4th vein. There are no bristles on abdomen except at tip.

Adult Muscid Files That Do Not Suck Blood —In a majority of the Muscide the proboses is relatively short and stout with fieshy labella and is adapted to licking or rasping but not to biting. (The maxillae and mandibles are atrophied, even in the biters). These files are important medically because as a result of their filthy habits of eating and breating they often convey infection mechanically, and because the larvae of some of them cause mynasis. The more important genera are given in the following Ley.

Hypopleural bristles absent
Sixth ven short fourth vene straight
Sixth ven short fourth vene angled at the distal end
Color opaque grands
black
Hypopleural bristles present

Color greenish or bluish black Basal section of first veio cibated

Jasai section of first veto citated

Face yellow one posthumeral bristle

Face black with black issues two posthumeral bristles

Prothoracic spiracle
light orange

Phormia

Phormia

Lucilia

Basal section of first vein bare
Upper surface of lower squamae bare

Upper surface of lower squamme pilose

Color yellowish or reddish non metallik.

Eyes of male approximated Five or more ranges of setae on orbit Cordylobia

Eyes widely separated One seta on each orbit Auchmotom-16

Musca Domestica —The common housefly Musca domestica is the best example of this family

The arsts is feathered both dorselly and ventrally with straight hum. The feath tongstudinal ven heads forward in a rather sharp angle as compared with Slemosys the feat posterior cell of the latter having rather a fusiform appearance. The eyes are close the content of the manufacture of the content of the contrast to the other fless in this group. Musca has no large bristle on the inner surface of tabas of the middle fegs. The femiliary about 125 eggs in a heap preferably in fermenting flours manuer. The farra comes out in about thirty-six hours. Very characteristic are the stigmata decorating the blust posterior ends. (See Figs. 370 and 375 p. 1516).

Wohlfahrus magnifica is a common cause of cutaneous mysass in the old world. Its habits are like those of Cecklemyna americana. W ngd is an American species which may be parasite. The larvae are deposted about the eyes or on the skin and in young children at least way penetrate the normal skin. Several ares have been reported in North America.



Pio 371 —Cam a lu d d * ng show ng nft mm t ry rea t on about sect o of m tob cyan ventris Magn ficat on Z as Compensati g Ocula 6 Obj cti DD (A II mitton R Harv d Amaz n Expect tion)

Destridae

The fires of this family are called warble or bot fires. They are large fires which superficially resemble bees. The mouth parts are vestigial. They have a large head with a somewhat filout of boding lower portion. They are often rather harry. The I rivae which develop from the eggs are paras tie in the intestinal tract. misal cavit es or subcutancious tissues.

Dermatable homens (D. eyaw rost st) as a large thack-set fly about 1g nm long with prominent head and eyes multi antennas and a marked autrowing at the pinction of the thorax and abdomen. The thorax is greynd, and the abdomen metallic blue The species is wise greed afternate large green fly and profit deepons. When ready to outpoint the first explaint large Parendburg mon, quitoes as they emerge from the pungs (and occasionally other but of or mon button, D petra or e to thexe) and deposit is to 25 eggs on the catral sid of the abdomen gluing them to it in such a position that the point of emergence of the barrs a threefed as any from the mosquito. When the mosquito bates either man or other annuals the warmth of the holy atmustates the contraction of the such and the profit of the such and the profit of the such and the such as the contraction of the such and the such as the such

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prevents the development of the larva to the skin and is often associated with local anaphylactic phenomena

Cochliomyia americana (C kominimorax) (Chrysomyia americana) was shown by Cushing and Patton (1933) to be the image of the parasitic screw worm in America The adults resemble Lucilia hut are somewhat larger and are distinguishable from them by the presence of black stripes on the thorax The eggs which number 250 or more are deposited in or about the nose or ears or in open woulds of animals or man. The larvae have 12 segments and are encurcled by narrow rings of minute spines which give them some resemblance to a screw They burrow deeply into the tissues causing extensive foul necrotic ulcerations and may penetrate mto the nasal sinuses In 1935 it was estimated that there were over 100 human cases in the southern United States In a series of cases compiled by Aubertio and Buxton the mortality was 8 per cent. The larvae mature after about 8 to 10 days attaining a length of about 12 mm They then leave the body and hurrow into loose soil to pupate C macellaria with which the preceding species has been confused is primarily suprophagous like Calliphora and much less dangerous. It is distinguished chiefly by the character of the floor of the pharynx which is ridged longitudinally whereas in the parasitic species this is smooth The larvae of the latter have larger spiracles and larger thicker traches tuhes These files are common in the warmer parts of both North and South America A related species with similar parasitie habits Chrysomyra be rana is common in Asia and Africa and often causes human infection in India (For treatment see p. 1514)

Blood-sucking Muscid Fires—Stomosys, Haemalobia and Glassina have a more or less elongated proboscis adapted for hiting Stomosys has delicate palpi shorter than the proboscis, and arista feathered only on the dorsal side with straight hairs Haemalobia has club like palpi about as long as prohoscis and arista with hairs dorsally and ventrally Glassina has thick set hut not clubbed palpi as long as the proboscis for which they serve as a sheath The arista is feathered on the dorsal side with branching hairs

Stomoxys calcitrans, the stable fly has been described in Chapter III African Trypanosomasis (Fig. 38) Stomoxys may convey trypanosome (and other) infections mechanically like the Tabandae This has been proved for T etans; and experimentally for T bruces, T gambients T rhodestense and several others The old view that it transmits pollomy eiths has been discredited

Glossina, the Tsetse Fires —This genus is limited to tropical Africa and includes about 20 species —Its description and importance has also

been discussed in Chapter III

Sarcophagidae

These flesh flees are distinguishable by the art ta which is plumose to the indoorn and bare at the tip. They are usually thick set moderately large flees dull colored with grey longitudinal stippes on the thorax. The abdomen is grey checkered (in Section 2) or spotted that are an expansion of the construction of the section 2) or spotted the section 2) or spotted and signal plates set in a deep cavity each with three parallel vertical slits. The numerous appears are difficult to identify

Sarcophaga haemorrhoidalis is a widely distributed spicies which may give rise to intestinal mytasis. Cases have been reported in the United States. S carnoria prefers

to denosit farvae in the vagina when accessible

of 5-10 per cent chloroform in a light vegetable oil is often very effective when applied for 30 minutes. Such treatment serves to cause the maggots to release their hold and they may then be easily removed following which antiseptic washes should be used to prevent the lesions from becoming infected with bacteria.

Laske (939) has shown that the hydrogen ion concentration of wounds resulting from the larvae of series v orms is of some importance in the selection of chemical reagents as repellants and for treatment. His stud es show that a high alkalanty of a wound renders it particularly attractive to the files and that a certain degree of acidity

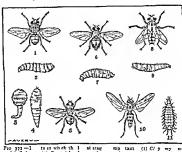


Fig. 331 = 1 is in which the last stage one task (1) C(f) my model is (2) C(f) to f and
is advisable for the healing of postmyiot c wou ds. He therefore suggests in cases where the healing of the wound is slow to acid by the wound either by local or 1 ternal med cation.

The larvae of many other species may secondarily infect nectotic t ssue in open vounds or ulcers and crasionally 1 vade f esh tissue. Among the more impo tant are chlomyia macilla to Visica domest ca and species of Calliphora Luc I a Pho m ophaga a d Fannia

Intestmal Mylases

to tropics and more rarely in temperate climates vague digestive es or violent abdominal cramps with diarrhoea and vomiting uight about by dipterous larvae in the intestinal canal. The sy be those of a disentery and may be attended by fever 1514 DIPTERA

As the larva grows a tumor like swelling develops with a central orifice toward which the posterior (pointed) extremity of the larva projects and through which it takes air into its spiracles. After 7 to 25 weeks the larva leaves the tissues and burrows into moist soil to pupate Harrell and Moesley (1042) point out that the larvae may at times burrow deeply and into vital tissues. For successful treatment they must be carefully removed. The subcutaneous injection of procaine hydrochloride anesthetics the parasite and renders complete surgical excision less difficult and painless

Hypoderma bovis and H linests the common warble flies of cattle and B diana the European deer but fly deposit their ova on the hairs of the legs and abdomen. The larvae after emerging penetrate the akin and migrate slowly through the tissues reach ing the skin of the back after about mx months. Here they cause boil like swellings (warbles) from which the fully developed larvae finally emerge. They occasionally infect man In Hypoderma the arista is bare while in Dermolobia th upper borders

plumose Gasterophilus nasales and G haemorrhoidales bot files of horses have a similar life cycle

The common borse bot G unlestenales (eque) lays its eggs on the hairs of the lore parts of the horse where they incubate for 1-2 weeks. When mpe the warmth and moisture of the horses tongue when beking causes them to hatch and the larva adheres to the tongue In the mouth they excavate tunnels under the mucous membrane and migrate to the stomach. Here they are often found in large colonies and his until mature and ready to pupate They then let go their hold on the mucous membrane and are passed in the droppings

O haemorrhoidalis strikes at the hos and nose of the animals to by its eggs and it the early spring the mature larvae leave the stomach and finish their development in the rectum near the anus A few of these hots apparently do httle damage but when numerous they cau e gastro intestinal disturbances in the horse. By the administra tion of carbon disalphide in gelatin capsules 1 5 drams per 250 lbs of horse the para

sites may be eliminated

G intestinalis is the form most frequently found in man. A number of cases of human infection have been reported. Man appears to be an unautable bost. When the larvae reach the skin they tend to migrate aimlessly and give mee to a creeping eruption similar to that caused by the latvae of the dog book worm See p 1521

Cutapeous Mylases

Ver Macaque -The best known of these my lases is that due to the larva of a botily Dermalobia hominis (see above)

The natives of most of the countries where the infection is found have called the larvae mosquito worms or gusano de zancudo. The cutaneous raelling some

what resembles a blind boil and may be as large as a pigeon a egg

These bottly boils tend to break down and discharge a sero purulent fluid and it is supposed that the larva when mature escapes as a result of the disintegration of the tumor

In Brazil they make tobacco jusce applications which cause the larva to protrude and then squeeze it out. The injection of a little chloroform into the larva with a hypodermic syringe prior to its extraction with a forceps makes the process less painful Ver du Cayor — These maggots which are the larvae of the Conjohn anisto pophaga are widespread in Africa They penetrate the skin especially of very young children who are not kept clean. The lesson rather resembles a boil

The Screw-worm -This is the larva of Cochliamvia americana (see

The eggs are deposited in wounds or orifices having offensive discharges The larvae penetrate into adjacent tissues and cause frightful destruction of all soft parts This infection is especially common in tropical and subtropical America and is important both in animals and man

Treatment -The larvae should be removed as speedily as possible since they may do a great deal or damage in a short time Applications

Ocular Mysases

The marrot of Oest us on s a species of bot fly known as the sheep head mag of sometimes invades the human eve. This species normally lays its eggs in the nostrils of sheep in which place the ma gots burrow into the frontal sinuses. In Algeria it lays its eggs at times while flying without alightin upon the eyes nostrils and lids of shepherds Infestation of the eye I do is also common in many parts of South America In Palestine reports have been made that the larvae frequently enter the eyeball Another cestred fly which attacks the eye of man is Rh cest s purpu cut a bot fly of the horse so called on account of its purplish color. It is found in Central Europe and in Africa as well as in Russia and Siberia. Portchinsky reporte that Siberian peasants are not infrequently attacked by this fly which rapidly darts toward the eye and deposits its young in that organ. The young maggots cause severe pain so that the lids cannot be opened. Their removal is affected by dropping cocaine into the eye and then extracting them with pincers or by washing. Other eye flies have been discussed under Osc midge D 1800

Urmary my as s of hoth urethra and bladder has occasionally been reported Usually the lesser house fly Fa a consculars and the closely related latrine fly F scalars have been encountered the infection having probably occurred from eggs laid near the external opening of the wicthia and the larvae working their way into the urethra and even entering the hladder. In one case reported by Patton of the larvae of Psychodo he thought the larvae burrowed through from the rectum to the bladder In one case reported by Chandler (104) Lucules series of may have been the cause of

DETERMINATION OF DIPTEROUS LARVAE

the ves cal d sturhance

There are certain points in the anatomy of dipterous forvae which must be considered in determination of the genus or family of the flies concerned in the various myrasee. The broad extremity is the posterior one and the tapering one the anterior The dark hook like processes which may be in pairs or fus di project from the anterior or head end and above them is a pair of projecting papillae. The second regment from the head has on either side project g hand or fan like structures with varying numbers of terminal divisio \$ 4 to 40 or more. These are the auterior spirecles

The large terminal segment has on its posterior surface two chitinised of tes with 3 elits of various architecture in each. These are the posterior stigmal plates and are the structures to which we pay particular attention in identification. In the early larval etages there is only one slit in the second stage there are two. It is only in the fully de eloped larval stage that we note the characteristic a slit stigmal plates. The pres ence or absence of a rounded protaberance or hutton at the base of each st smal plate sh uld be looked for The area carrying the stigmal plates may be sunken to form a nit

KEY TO THE LARVAE CAUSING MYTASES-THIRD TOSTAN (Adapt & from Banks after Fax)

s Body with spinous or fleshy processes laterally and dorsally or terminal

Body without spinous or fleshy processes

2 Body flattened with long lateral and dorsal spinous processes Fannsa (Hamalomysa) Body with long tail like picess E istal s Body end g 1 two small fleshy proces es bearing the stigmal plates rather small

species body about 5 mm 1 mg D osophila Same b dy ahout 10 mm long Proph la 3 Body robu t o ate cylindrical rounded at ends slightly depressed or body pyriform

Oestridae 4 Body truncate broadly rounded at one end and t pering at the other (head) end 6 a Larva fi sk shaped heavily spined posteri r spiracle has three distinct slits Dermatalna

Lar a grub like heavily somed Three s nuous spiracular openings Gasteroph lus

Stigmal plate solid with many fine openi gs button distinct in depress on in the plate Пуродетта

2

The larvae usually obtain access to the alimentary tract on food especially if tainted which has been exposed to files It is possible for thes to deposit eggs or larvae on the skin about the anus while the individual is at stool or otherwise exposed particularly if the skin is soiled. The larvae may then crawl into the rectum the vagina or even the urethra Many species have been reported. Among the more frequent are Pann a canicularis F scalaris Musca domestica Sarcophaga Muscina (the non biting stable fly) Eristalis Apiochaela scalaris and Piophila cases the cheese skipper The larvae are passed eventually in the stools or vomitus. Refere making the diagnosis it is neces sary to exclude the possibility that larvae which may be found in the stool have been deposited on it subsequent to its passage

Much discussion has occurred recently in regard to the occurrence of human intes tinal myrasis. Some doubt that any of the numerous species of fly larvae found in human facces that are ingested stay in the alimentary tract and nourish themselves or much less multiply in the human intestine. However the evidence seems to be against this extreme view for there would appear to be some well authenticated cases of digestive and intestinal symptoms caused by them in man. The definite evidence that Gasterophilus is a true parasite of the alimentary canal in horses is discussed on p 1514) Even when in man the parasites do not attack the mucous membrane they might cause nausea and abdominal discomfort by their movements. Herms and



Fig 373 -Larva of Cal I she a semuler a right of natu ral size left enlarged



For 374 -Larva of An thomy o can e large enlarged Rarely found in the tool (Alter Gould)

Gilbert (1933) described a human case in which the history suggested intestinal mytani that had extended over many years For 4 months the larvae of Calliphora Lucilia and Screepings were found at intervals accompanied by attacks of severe abdominal distress and intestinal haemorrhages The maggots in a number of fires seem at times to have comparatively powerful resistance which would lead one to expect that if accidentally suallowed they might survive and pass through the stomach into the intestine Accertheless Causey (1938) who fed larvae of a number of species to dogs and cats found that the parasites were killed or immobilized in the stomach within 3 hours and never passed through the alimentary canal abve Hence Chandler (1940) suggests that intestinal myrasis when it occurs is probably associated with low hydro chloric acid in the stomach or with conditions favoring rapid passage into the intestine

Aural Mynasis

While the larva of Cockhomyra americans the acrew worm is that most frequently reported from the external auditory canal many cases have been due to Sorroghage Calliphera and Anthomyre (Fonnia) These larvae are usually deposited in the canals of those with otorrhoea The nosal cavities and even the eyes may be attacked The symptoms are intense ear ache guidiness and possibly convulsions. The larvae tend to perforate the tympanic membrane Solher (1913) in a child 4 years of age with an ear discharge and pain removed in the course of a day's 87 larvae of Chrysonyus be cane (See p \$512) Basso (1039) in a study of 197 cases with mytania in Mendoza Argen ting found the pasal praces were affected in 64 per cent the ear in 5 per cent while in the remainder the skin (wounds and nicers) were infected. The flies concerned were Cochliomyia hoministorax and Sarcophaga barbata

Trestment -Instillations of roper cent chloroform in milk or the use of mils kills the larvae in these infections

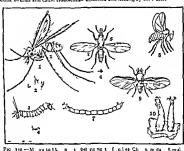
Schwartzwelder calls attention to the fact that 22 cases of human infection have been reported in which syrphid larvae usually of Erenghi tenax have been found All were of the gastrointestinal tract but me in which the nasal tract was the site of infection

streams or water falls. These breed ng habits explain the patchy distribution of the flies

S multi 1 damnosu n and S no es serve as the intermediate hosts of Onchacerea robustus in tropical Africa In Central America the known vectors are Eurimidium

melallicum (avidum) E ochraceum and E callidum (moose s)

Charmonimides (Midgest) —These are manufed fless manging from a length of 1 or a min down to almost incorpoop; disseminences. The wange are autrum whorstee than the abdomen often aported with the first two longitudinal we us heavy the others indistinct. They hear has but no scales. The nationals are relatively long and have 13 points. The problems is short. Most of the species rest with the fore legs elevated. The great majority of the species are harmly 32. The blood sucking sprease belong to the family Ceratopogoniane and most of them to the great was full sides. These fites usually appear in dones an area and cause twolebooms trivitation and trianing by the 7 hase.



rw 370—at quito ik n t bed ræng t i nies Ch n med S mull t ad Pyhod (1) flukbim papis (2) Papis (ntur 2) (3) Ppis (1 (vr) 4) Ppas karv (natu 1 e) (3) Cerippn pi (3) C pis (n tu 1 aze) (3) Ch om kar (4) Allitud of a S m i km (5) S m i m regt s (10) Larv of Sim i m

Cult of 1 g show and C susten are the intermediate bosts of the filance worm chankhocknesseng systems in Birth 6 Cam sous. O y the features but and they but only in darkness. C f car was shown by Burkley (1933) to be the intermediate bost of Montovella v of in St Vincent. The fly who has a toublesome buter is found in the costal region from Flow 1s to Brani.

Townsend has advan edevidence that related in dges Forcipomyra uta and F town s nds are vectors of dermal leishmannsis (uta) in western Peru

Psychodidae (Moth Mdgen) —There are small strader dies with very long leg. The body and suns; are covered with 1 at hum? The wings show none longitudiate as which reach the ma gas and cross verms only near the base. The antennan are 1 ag and hum; and com sit of 1 to 5 points. The plagh hate a gainst The majority of those flesh have a short probless not adapted to bit ng (the Psychodinae). A rela twely small group the sand die (thibbloommae grams Philosoman) are bitery. They

have a long proboscis as long as the head and mouth parts like a mosquito. The palpi

1518 DILIERA

6 But one great hook posterior stigmal plates D shaped with winding sixts no distinct lateral fusiform areas tip of body with few fany conical processes. Musca domestica One hook stigmal plates irregularly rounded with winding slits. Slowery: With two great books, slits in the stigmal plates includes.

7 No tubercles about anal area no distinct processes around stigmal field 8 Distinct tubercles above anal area often process around stigmal field lateral

fusiform areas usually distinct

Institute areas usually distinct
Stigmal plates on black tubercles lateral fu iform areas distinct
Stigmal plates of black tubercles lateral fusiform area indistinct stigmal
plates often continguous or nearly so shits long and subparallel
Tripetide

9 Slits in stigmal plates rather short and arranged radiately

10

Slits slender and subparallel to each other

10 Two tubercles showe smal area stigmal field with distinct fleshy tubercles around it Anthomyndae (except Fornic)

Four or more tubercles above anal area slits of stigmal plates usually pointed at one end bent surrounded by dense chitmous ring

Mutures

If the plates at bottom of a pit no button slits subparallel to those in opposite

of Stigmal plates at bottom of a pit no button suits supparailet to those in opposite plate Sarcophagidae

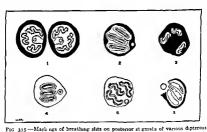
Stigmal plates not in a pit

12 Chitin ring open messo ventrally no button

Chitin ring closed Button present

Lucilia Calliphya

Lucilia Calliphya



1 Arto 373 — Asiar ing of orestaining sale out posterior a collapsor womitoria 3 Simmoyr cell trar 4 Asia e omy a lated 5 Cordytob a a thropophoga 6 Sacrophoga magn fice

Simulation (Buffalo Giatts Black First) —These are small first from 1 to 6 mm long. The body is stout and the thorax is bumped. The sings are broad with conspicuous interior veries. The legs are short and the proboses is short and incompicuous. The antenna have eleven joints and are shorter than the head. Many species have been described. These dies are abundant throughout the world. The femiles (only) are vicuous biters (by day light). They may occur in supurins not done as to make infected districts almost usunhalitable and to cause senous destruction of live stock. The larvae which are very characteristic (Figs 31 and 376) require abundant oxygen. They are commonly found statched to slightly submerged rocks or vegetation in clear flowing streams the American species noted below occur in sulfitly fowing mountain.

In South Africa. Murray (1930) has found creeping eruptions of sand worm as 11 is called very common in Natal and Zululand. He has found that in these regions the burrows are produced by a mite possibly related to Tethonychius indetensions which he reports is found in the Argentine and Uruguay where it attacks both man and animals. The cracks in the skin are about 0.3 mm in diameter. The mite and some times its eggs are usually easily demonstrable at the end of the burrow. Another important cause of creeping eruption is the larval form of Anylotions for alternar which is found in both cats and closes of North



Fig 317 -- Larva m gr no (After Cors n)

and South America. Creeping eruption is apparently only caused by the third stage larvae of the above hookworm positive results not obtain ing from experiments with 1 cannium the common hookworm of dogs. Juby Smith holds that other ancylostome larvae may produce ground inch but not creeping eruption. (See p. 1266 for a more detailed discussion of this form.)

Sandground (1939) describes a personal expensions of 53 days of urnation often informating which followed the spulling on the finger of infected larges of A for other and of a B days and
Treatment—Dayloy (1941) recommends for treatment of the form due to fly larvae that the skin be first thoroughly drawd and detailed as the alcohol. Cefar wood out is then used to clear the skin of the affect of area, which is then examined with a §4 such objective of a dissecting microscope or with a good handlens. The ends of the burrow must be tarvally transmed as it as here that the off favor may easily be found where it

are longer than the head The antennae have 16 constricted joints They are further characterized by the wing venation the second longitudinal vein bifurcates at a con siderable distance from the base of the wing instead of near the base and has three distinct bianches When at rest the wiogs are raised over the abdomen at an angle of

Differentiation of species is difficult and depends on slight variations in wing venation length of the palps etc thus the second segment of the palps in P papaism is a little longer than the third in P permittosur the segments are equal in length while

in P minutus the second segment is only half the length of the third.

Phlebotomus papatasu is the vector of phlebotomus or pappataci fever This species is ahundant throughout the Mediterranean region, the Balkans, and Asia eastward to India The flies hide in damp shady places during the day. The females emerge at night to hite mao or other animals They fly only short distances and raiely rise mote than a few feet above the ground A few days after hiting they deposit their ova (40 to 60) by preference in crevices al damp shaded rocks stone fences or runed build ings or in caves within one or two bundled feet of their feeding places Occasionally they may bite a second time and deposit a second batch of ova but their life span is short 7 to 14 days The life cycle occupies 1 to 2 months. The virus of pappatari fever is acquired by biting a patient during the first day of the disease. The period of incubation in the fly is about 8 to 10 days. The virus is transmitted to the succeeding generation of flies which appear to constitute the reservoir of the infection

P verrucarum and P noguchis are vectors of Bartonella bacilliformis the cause of Oroya Fever and Verruga Peruviana in Peru (Tounsend 1914 Noguchi et al 1929 Ifertig 1938) Their distribution in the canyons of the western slope of the Andes

corresponds closely to that of the disease

Sand flies are probably the vectors of Leithmania (See section on Leishmanians) The species incriminated are For L donorani-P argentipes in India P major var chineness and P sergents in China and P major P sergents and possibly P papalasis in the Mediterranean region (infantile and camine infections) For L tropica-P papalism and P sergents in the Old World and probably P intermedius for L bra iliense in South These species have all been infected by allowing them to bite a patient with America the disease and cyclic development of the parasite within the files has been observed

Man and animals have in some instances been infected by injections of suspensions of infected flies and by rubbing infected flies ioto the abraded skin but not by ample biting Crushing the fly while biting seems to be necessary to convey the infection Only in the case of several hamsters have positive results been obtained by hiting experiments with P argentipes and the Leishmania of kala azar (Smith Halder and

Ahmed 1040)

Harara is a disease well recognized in Palestine and has been described by Theodor as an allergic reaction due to the bites of Phlebotomus at the height of sensitization Theodor studied the effect of successive bites of Phlebotomur papalassi on some 17 indi viduals not previously bitten After the first time they were bitten the reaction usually takes several days to develop then intensely itching papules appear After subsequent bites the papules appear more rapidly The site of the pieceeding bites may become inflamed again

MacPherson (1941) reports that the men of the Australian Forces have suffered severely in North Palestine The exposed skin becomes covered with hard weals up to I centimette in diameter these may subside of may be replaced by blisters which later may become infected and in some cases the regional lymph glands may be enlarged

and tender

Larva Migrans -Other names for this thread like swelling under the skin are creep ing eruption and mysasis linearis. The typical case as occurring in Russia or South Africa is due to the bullowing of a fly larva under the skio The patient first notices a painful spot which changes from day to day as the larva works its way along at the rate of about 1 inch in 24 hours The tract of progress is marked by a dark reddish line which terminates at an opening discharging a sero purulent I quid and from which open ing the larva escapes The line fades as the larva progresses The burrows may be found even on the face but more commonly on the feet or legs The fly larvae chiefly incriminated are those of Hypoderma and Gastrophilur

It is well recognized that other parasites than fly larvae may give rise to a creeping In Gnathstoma spinsgerum infection there have been reported a number of

cases of deamatitis due to this nematode

Mosourtoes

Mosquitoes (Culicidae) are of the greatest importance medically not only from their influence upon health in general by reason of interference with sleep and possibly from direct transmission of disease but more specifically they are the only means by which natural infections occur with such diseases as jellow fever malaria filariasis and dengue. In addition a number of diseases of animals are transmitted by mosquitoes

D section of the Mosquito —In can action with the diagnosis of mosquito borne d cases and their prevention dissection of the mosquito is often important

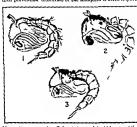


Fig. 320 -- Mo qu'to p pa (3) C i x p p e 3 (2) Ard e grpii (3) A ph i p nilipe (After Howard Dya h, ab by ourte y f Carnegi Institut n)

The easiest way to secure a mos zu to for d spection is to use an ordinary test tube Slipping the open end of the test tube over the rest ng mosquito by a slight mo ement the insect will fly toward the bottom Then quickly insert a cotton pl g If it is not dest ed to study the scales the best way to kill the mosquito is by striki g the tube sharply against the thigh but if it is also desired to study the scale characteristics it is better to nut a drop or so of chloroform on the I wer part of the cotton plus. The vapor falls to the bottom of the tube and kills the mosquito. Take the mosquito out pull off legs and wings and then place the body in a d op of salt solution on a slid It has been recomm nded to smear the surface of the slide with bile wiping off the excess bef re commencing the dissection in the asit solution. Then hild the interior end of the tho ax by pressure of a needle. With a seco d needle in the other hand gently crush the chiti ous connection bet een the sixth and seventh segments of the abdomen Then holding the thorax in place at addy and go tly pull away the last segments. If this is done properly a deli ate gelatinous whit grass will all why float out in the salt solution. One should be able to secure the alimentary canal as far up as the proventr culus which is just anter r to the stomach. The malarial sygntes de el pantle stomach. Proceed ne fom before back e el we ha the proventriculus which is a sort of muscular ring at the pening of the st mach or mid gut and marks the separation of the stomach from the oesochagus. Opening a to the lower part I the oesophagus are the oesoph geal diverts la o crops which are food reservo ra Occasionally in a d section we pull out these structures which are three in number

stands out clearly as a white, spherical mass. Having noted the position of the large the skin is cleared for operation and a minima of procaine 1 1000 is used to detensity as a area half an inch in dismeter with the large in the center and cautery is their applied and a small burn produced. Each burnow must be examined and whenever a large is discovered the cautery should be applied. When many of the burrows are containmented by bacteria sulfamiliantly has also been employed for its disinfecting effect. Usually in 3 days the small tesions are their discovered the small tesions are held.



Fig 378—Cre ping eruption mid die aged woman sbowing multiple uninfected rapidly developing lessons of approx mately two we ks duration both limbs being avoived (After k rby Smith Dove and White)

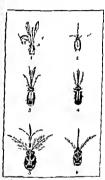


Fig 379—Heads etc of mo qu toes tands male and male final Cater quing for cookin 3 and 4 mais and female A des oxphiles and 6 male and female A des oxphil (After Statt) (From P H Repo ts)

For treatment of the form due to ancylosiums. Ectron has advocated the use of cityl chiloride applied as a gray to the extreme advances grown of the lesson until the tissue is frozen about one manute's application usually sufficing. Frequently a second application is not required. Lowerschaft (1999) the has found used treatment valuable and carely provong ineffectual if m additions the advancing part of the limits when from the state of the second care the second care that the state of the second care the second care that the second care that the second care that the care the property of the second care that the care the property of the second care that the care the property of the second care that the care that the care that the second care that the care that the care that the second care that the second care that the care that the care that the second care that the second care that the care that the second care that the seco

exceedingly highly refractile appearance. To examine for sporozoites cover the glands protruding from the neck with a cover glass and search with one sixth objective for marrow curved bodies in the substance of the glands If they are present try to smear out the glands between the cover glass and slide ky pushing the cover glass along then withdrawing the cover glass dry quickly and stain the smeat on slide or cover glass with Wright's stain

The sporozoites are narrow falciform bodies about 124 in length with a central

chromatin dot

A matter about which there is disoute is as to whether the salivary glands communicate with the alimentary ca al. Theobald states that there is no connection between them The chief genera of importance from a medical point of view are Anotheles Aedes Culer and Vansonia The classification of mosquitoes

and the description of the important species concerned in the transmission of malaria (the Inobheles) are discussed in Chapter I Actes and Culex are of great interest medically because species of

these genera transmit filariasis dengue and vellow fever. Culex mos quitoes are the principal vectors of bird malaria

In contrast to the implet s the ordinary Culex has the following characteristics The larvae have a siphon and the body rests at an angle of about 45 with the surface of the nater. The nings of the imago are a rule not spotted. In the female the palpi are shorter than the probosing. In the restin p siti n Cule allows the abdome ; to droop so that it is parallel to the wall. The a gle formed by the abd men with head and p of oscis g ves a hunchback appearance (see I ig 19 p 36) Culex quinquefasciatus (C f f g n) is the most important vector of filariasis (B

b ne ofti) It is a medium s zed reddish br un mosquito Legs and proboscis have blackish scales the femora are pate by wn at base. Abdomen blackish above with moderate basil segmental vb tish bands separated from the lateral spots. Wing

scules are narroy and hair like wholly do k

The larvae occur in artificial receptacles most frequently but are also found in ground pools even far f om hahitations

This : the common house mosquito of the trop es extending in the Americas to about latitude 35 n rib and south It is act ve at night

Culex pipiens very sim far to the pre eding species as the common house mosquito la temperate regions. It is a vecto of filaria is in Fgypt China and Japan

Species of Mansonia are especially concerned in the transmission of

Microfilaria malayi For other species transmitting filariasis see Chapter \LVI where a list of those concerned is given

Aedes negypti (Siegomyra fasciata S calopus) is the principal vector of yellow fever and densue and is therefore of extreme medical importance (see Chapter \\III Fig 200) It is small in size blackish brown in color with silver stripes on thorax abdomen and legs. The dorsal surface of the thorax is marked with two parallel lines with curved silver white lines outside (lyre marking) The proboscis is black the tins of the palps white. There are silvery scales on clypeus

These mosquitoes re often called domest cated an e they are observed to breed and pass the r I ves in the immediate environment of man and furth r to be d stinctly urban rather than rural in their di tribut on For their b ceding places they choose artificial collect ons of water such as cisterns barrels pail bottles cans or empty tire casings in or near dwell nes1524 MOSQUITOES

Leading from the stomach we bave a hind gut, which ends in the rectum.

This has a posterior dilatation or rectal pouch which usually has three or four rather.

This has a posterior dilutation or rectal pouch which usually has three or four rather marked anal papillae

Taking origin at the posterior end of the stomach and festioning the hind gut are five longitudinal tubes—the Malpighan tubules. These are characterized by large granular cells with a prominent refractile nucleus. They are regarded as the real structures. It is in these tubules that the embryo of the Filapsa immits of the dig



Fig. 31 — (4) D again of the mal gen take of Actor (A) a dept e. [B] layer (C) lebes of an proc (D) roths in t. (L) classiset (8) mayon on (G) of the it of Aft r Howard Dyar and Anab by court y of Carnege In titution) (c) cutes in Thribode suct timm and the metanotum (A) Rabet in Throunded suctions and the metanotum (A) Sabethm spaces | S dev w of the metanotum showing that of settes

develops. In the female mesquate the parts withdrawn may seem to be largely made upon of the white voil owarts. These are connected with the spermathecea in which the permatagons are stored after fectordation by the made. In the male the testeless are quite distinct. Next to the examination of the stometh for systems which appear as warf like excressences onts outer surface the most important structures are the salivary glands where the maliant sporcosters are found. The eassest way of sect out the sulvary glands is to press down firmly but gently on the anterior part of the thorar and then with the shalf of a second needle pressing on the head to gently draw the head wasy from the thorar so that by this expression and traction movement you cuttied them with the bed segment. They are very mount and are to be recognised by their

exceedingly highly refractle appearance. To examine for sporecoites cover the glands protraining from the arrier with a cover glass and surrier with one surts objective for marrow curved bodies in the substance of the glands. If they are present try to mear out the glands between the cover glass and shele by pushing the cover glass along them uithdrawing the cover glass dry querkly and stam the smear on shide or cover glass with Wight's state.

The sporozoites are varyow falculorm bodies about 22µ in length with a central chromatin dot

A matter about which there is dispute is as to whether the salivary glands communicate with the alimentary canal. Theobald states that there is no connection between them.

The thief genera of importance from a medical point of view are inepplies Aides Culex and Mansonia. The classification of mosquitoes and the description of the important species concerned in the transmission of imiliana (the Anopheles) are discussed in Chapter I.

tedes and Culex are of great interest medically because species of these genera transmit filariasis dengue and yellow fever. Culex mos quitoes are the principal vectors of bud malaria.

In contrast to the 4 m gh l s the ordinary Cul s has the following characteristics. The larma have a spinon and the body rests at an agric of about q, with the surface of the nation. The surge of the inage are as a rule a t spotted. In the firmals the paging are shorter than the probosors. In this returns position Cul is allows the abdomen to droop us that at a parallel to the nail. The angle formed by the abdomen a this head and preboses gives a bunchlack that appearance (see P in P in P).

and promotes gives a nunclasca superance (see * g to * p to*).

Culter quantifestactus (§ for gass) is the int temporator vector of filariasis (B

6 nc 6f). It is a medium and editish be no monoquita. Lega and probosics have
hackish scales the femora are pale bown at bass. Abdoment blackash above with
moderate bassi segmental. hitish bands separated from the lateral spots. Wing

scales are narrow and hair t ke wh liy do k.

The larrae occur in artificial receptacles most frequently but are also found in

ground pools even far from habitations

This is the common house mosquito i the tropics extending in the Americas to about littude it north and south. It is active at night

Culex pipiens very sim la to the prec ding species is the comm n house mosquito

in temperate regions. It is a sector of filams is in Fgypt. China and Japan.

Species of Mansonia are especially concerned in the transmission of Microfilaria malaxi

For other species transmitting filamasis see Chapter LLVI where a list of those concerned is given

Ardes segypt (Stegoniso Jasciala S. caloput) is the principal vector of yellon fever and dengue and is therefore of extreme medical importance (see Chapter NAIII 19, 2000). It is small in size blacksh brown in color with siter stripes on thoray abdomen and legs. The dorsal surface of the thoray is marked with two parallel lines with curved silver white lines outside (15r marking). The probosous is black the tips of

the palps white There are silvery scales on clypeus

These mosqu toes are often called d mesticated since they are observed to bee d and you then here in the immediate environment of mon and further to be d stinctly utban rather than ut at in the distribution. Fr the recent on places they choose artificial collections of air r such as crateria barrel pails bottles cans or empty tire causes in our near deciliars.

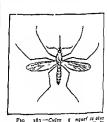
A acypti is a visious feeder and very sleet. Only the female bates blood apparently being necessary for ovulation. It feeds especially during the morning and afteriors hours—much less commonly at night unless there is a light. To become infected will vellow feer virus it must take blood from a yellow feer patient in the first two or three days of the disease. After sucking the blood of a yellow feer patient the morning quitoes cannot transmit the disease by Issing a person non assument to yellow feer so a period of twelve days. After this time the mosquito remains infective for its life—in one instance fifty seeven days.

Addes albopictus (Stepomyra scutellarss) has a single silvery stripe down the center of the thorax. It breeds particularly in receptacles about the house. It is common in the orient at his been proven to be a vector of dengue and (experimentally) of vellow fever.

Recent work has shown that several other species of Aédes and related genera may convey yellow fever experimentally and perhaps under natural conditions



Fiu 382 -Culex quing fs ius male (After Howard) (Fom P H Reports)



f male (Aft r Howard) (Fr m P H Reports)

Biraud (1935) and Faust (1940) have lated the mosquitoes other than Acides acgypti which have served as efficient or as good incubators of yellow fever virus based on experimental evidence (See table 1 opposite page)

In jungle yellow fever (see Chapter \\III) found in numerous areas in South America where 4 args pli is complete), absent the transmitting insect of the disease has not yet been demonstrated although the infection has been transmitted from patients by ledes args pli to rhesus monkeys

has been transmitted from patients by least stay in the same the factor of the same species have been found by Shattnon Whitman and Franco (1938) to be naturally infected in Brazilian forests

In addition the arthropods other than mosquitoes listed in table 2 (opposite page) have been reported to be efficient mechanical transmitters only (i.e. through interrupted blood meals) (Biraud 1035)

TABLE 2 MOSQUITOES OTHER THAN ARDES ARGUPTI INCRIMINATED IN YELLOW FEVER BASED ON PROPERTY LANDSHOP

Spe	Datab t	Bared g plac a
AN p T	Eth p	T e-b l tump iso sem
Alt phi	W Eth p n.	T ht cut b mboo
A imp †	Eth p	Tohtal ful
A 13	W Eth p	This be distributed at map
A PRI T	Esb p 40 t1	Rock pool m td gutt re
A 1 1	W Eth p	C bhi
A stable	W fith p st	C 6-k1
A p ctor tol t	W Eths p	Crab-h 1
Affinist t	Neut p 1	Rocke t t gn ns
A >1 1	N trop 5	Rap po t
d er i t	k t p I	Ra pools
AI I I	N 1 p 1	U 1 al a
A 57 f	Nactrop 5	
A to to	N. 1	T 53
A g wit †	P) (Naot p cal	T +his
A f Insher 1	h trop 5	T his
A lb plu 1	On 13 4BA 1	Dm 1 mil t & gypt
A COLY 4 12:	A 1 1	T +b1 1 bil 1
nt William	" · •	t sh h
E etm sad (A yang er t	Etho ga	Tobl tmp les sem
		dat
CW fig !	T p 1	Dass
Cupi	N trop 1	
CRI 1	W Eth pt	Creb b 1
M fru t	Eth p On th	Aq t pl q
M form t	W Sibl p	Cottwap a d mab
At t bile t	Neotrop I	Att båt sedg dag m
M f at m set	h trop t	
At he semt	hactrop t (B & ly)	Att bedt mede ud Eg im
R all 1 1	Neot p 1(B I ly)	Att båt sede a dEg etm
37 t ill 1	heat p 1	Attach de fi tew t pla t
Person alt	N trop 1	I wood dar daem d m ti
P fer 1	Neotrop	Bild I wood dares
Hyern 5 ml mt 17 obla 1	N tropscal	B mboo ; f t
L mai & A mit	h trop t	Wit hid gpl in
H m c A my t	Restrop 1	f ttdmttt
II tax	heat p 1	F 12
B m" t	Nactrop 1	Ems

Efficate m m 9 Good 4 R sor

TABLE 2

OTHER ARTHROPODS REPORTED AS MECHANICAL TRANSMITTERS Species D Intert St mo # ter re C to polit a. 5 . 1 4 4 b rz. Ci oc ph 14 Come point n. N E t fter 7 hours Cim tect ? T repered so Fece floctive Cim h m pt ru Tropical P trog 1 mg t Sectrop cal SELW ! y hours

800

heg 2

Ites 4 8 hours.

aft 4 \$ hours

ft.er 3 bours.

Fhep n.

Neutrope 1

D met

One hadoru m b Ambly mm 's T 100 011 1

Aedes variegatus (Stegomyta pseudoscutellaris) resembles A albo pictus but has white hands only at the sides of the abdominal segments It is widely distributed in the Pacific Islands in which it is the vector of filariasis (non periodic strain of 11 bancroft). It bites by day

A togot and A chemulpoensis of Japan are effective filarial vectors but

in A aeg pti and A albopictus development of the parasite is incomplete Psorophora—Species of this genus have been incriminated as being passive carriers of lari, ac of a bothy (Dermalobia hominis). These larvae when the mosquiro alights on the slun of man, emerge from the egg case, penetrate the slun and set up a cutaneous myrasis. See p. 1514. Species of Actes (A aegypti, A albopictus, A taemorkynchus, A soliticitus A texans A caulator, A dorsalis, A migromaculus, and probably others) are biologically capable of transmitting the virus of equine encephalo myelius. This is of particular importance in view of the increase in reported human cases of this disease. Human cases have been reported especially by Merrill and Ten Broeck (1935). Simmons Reynolds and Cornell (1936) and kelser (1938). The definite matter of transmission of the human disease has not yet been determined.

Uranotaems —A small genus mainly of tropical distribution. The larves live in ground pools and have a superficial resemblance to Anopheles from the elongated black head and the habit of lying flat in the water although the larves are not surface feeders. The adults are ornamented with hors of metalike blue scales.

Megarhimus — A genus of large showy insects of tropical and subtropical distribution. The adults do not bute the proboscus being curved and stapted to extract boosy from flowers. The larvae found in tree holes and similar locations feed entirely on other mosquito larvae. The species of this genus should be classed as strictly beneficial to

man On account of their restricted habitat the species are rare

Mosquito Eradication—Mosquito eradication in connection with malaria has been discussed in Chapter I Being in practice a problem of engineering and municipal administration rather than of medicine, it will suffice here to indicate the means employed, according to circumstances in ridding a district of mosquitoes

In rural districts where the malaria-carrying mosquito breeds the measures tipe cally applicable are (i) Removal of collections of stagmant water smalled for breeding by surface or authoril drainings by permitting free access of the tide water or by filing in as in the case of small plonds and wells (2) introduction of fish which per on larvat and puppe (2) cleaning away advantse vegetation from the banks of streams and ponds

and (4) use of physical or chemical larvicides as oil or Paris green

In urban and suburban districts where the mosquitous transmitting yellow fever dengue and flarmass are likely to brief the measures are (1) Piping the water size to remove need of eisterns (2) screening covering and oiling all water constants (3) removal of all rubbinh that may hold water as bottles and in case (3) desirable surface collections of water or * bere that is not possible (3) employment of larworld measures (6) as a substitute for these neasures in has been shown that the introduction of the small mosquitod destroying fish into eisterns tanks etc will prevent the breding of mosquitoes. Often fish cannot be depended upon to destroy all larvae in natural bodies of water where larvae and pupies are projected by surface vegetation.

A number of chemical agents may be employed as larvicides The so-called Panama larvicide formulated and used succe sittly by Mason was compounded as follows. Add 200 pounds prowdered resum to 150 gallons crude carbolic acid. Heat mature to

212 F until uniform liquid is obtained. Danolve up pounds causite soits in 6 allors of water and add to matture shrings bit sly. Keep at boiling port until a sample methods of matter and the sample methods that have been supported by the sample of the sa

Other larvacides are referred to in Chapter I See also Appendix P 1744

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A number of chemical agents may be employed as Larvaedes. The so-called Panama larvaede formulated and used successfully by Mason was compounded as follows Add zoo pounds powdered rema to 150 gallons crude carbolic acid. Heat musture to

manifestation. With the Protecto lypha where belong the dangerous snakes, we have grooved or canalized por on fangs attached arteriorly to the marilla

Colubridae -The three series noted above belon to this very large family. The personous and ies belong either to the Hadrophinae (sea snaker) which have an ecl shaped tail and a rather flattened body or to the Elapinae (land snakes) which have a round tail. As a rule sea snakes here in salt water near the h re but such enakes have been reported from a fresh water lake in the Philippines They are of importance in the tromes and are a source of dancer to f. hermen While their venom is extremely toxic. and their fames situated ar emorly the danger from them is minimized by their small heads and relatively inefficient bite. The blap use have short atrong lanes anterioriy located and behind them small grooted (not canals ed) teeth. The person gland which is the homelogue of the carotid has a fact k cated in the upper hip and terminating in a papilla. The po son duct dea not enter the lang lumen but empties it to muscular folds which surround the base of the fang bence breaking off of a lang does not necessarily more the duct. There is a succession of seeth in sinker so that a new lang grows out if the one nal one is extracted

Many of our harmless makes su h as the garter snake and blacksnake belong to the Colubrative

The cobras belong to the subfarmly Elas mae and some are best known by a neck like expansion is hand. The only passonous colubrate anakes in the Leited States at the beadanake (Mi en un fulten) often cal ed the Florida cor I snake and the Sonoran coral (M cru oules surgrentius) Both of these makes were fremerly included in the genus

E2aps The beausnake is bis k with about 17 broad crimson bands bordered with vellow Although small they are very venomo is. The upy or jaw has apteriorly grooved fangs which appendages are not present in the non-po sonous coral anakes, these latt a having teeth in the upper raw so that the wound about a rows of punctures instead of a rows and one larger puncture on each a de to mark the entrance of the lange

In Asia there are many impo tant poisorous colubrin states the cobra (Laja (sand and) the hine cohes (\are busears) and the braits (Busearse fo ciaiss) All of the Australian poisonous snakes are colubrates

SHARLS OF THE U ITED STATES (STILES)

(A) Pupil of ey vertical pit present single row of ventral scales posterior to the vent adults with head more or less triangular constriction behind head more or less hominest. I'it vipers fall poisonous)

(B) Puril 1 eye circular out absent doub cow of vents I scales poster or to the vent (a) Color first hand on head bla k Coral snake (poisonous)

ib) Color tirst ban I on bead not bl. k Talse corals (not poisonous) (c) Color all others Not naisonous

Viperidae - The spierine snakes are generally characterized by a broad head narrow neck short and stumy v tail and a sh et opper raw whi h with the langs is directed obliquely backward. The rattlesnake (Crotolus) the copperhead (4mistrodon con torir a) and the water in coasin (4 ps 1 us) are widely distributed in the United States

There are many farmicy anales which more or less resemble these. Fit Upera as the rattl rs moccasins and copperheads are called. This term refers to a deep hal at get found on the side of the bead between the rostril and the eye. It is a blind sac. The much drea ed fered tance Boltrope lan coluta) is a crotaline

Some di ide the Viperidae into the Crotalinae which po sess the pit and the Viper mae which do not have this structure Ru sell's over (Dote a russel) is one of the best known I the lipers ac and is one of the most important poisonous snakes of India.

The posson langs are groo ed se perforated and t precited with the posson slands which resemble ashvary glands and may be almost an inch in I agth in is to snakes The tongue is slender and f rked and is a tactile organ.

Chapter LI

POISONOUS SNAKES AND LIZARDS

SNARES belong to the Class Reptilia and the order Squamata sub order Ophidia The two families to which poisonous snakes belon, are the Colubridae (colubrium snakes) and Vineridae (vinerine snakes)

Although the toxicity of the venom and the amount normally present are matters of great importance in estimating the lethal powers of species of possonous anakes the principal feature to be considered is the ability of the fangs to introduce vecom into the its use of the saumal butter. For example is the Ops thoshyba there are large



Fig 384 - Dabois russells (After Mense)

statehed to the manife but there are placed posterously to the solid teeth in front so that since the recommendate the normalized these marks are from a persical point of view non postonous. Then too masks in which the fames are so situated have only a small poston plant and their venome in of low tourity. In dangerous such architecture fames are placed antenority attached to the manifia which in the postonous Columbia is long and the bomonousla and in the Vependue or short and low vertices.

The non venomous anakes are in the Aglypha series and have solid teeth. There has been a question as to a tone salwa of some aglyphs but this is probably an allerge

manifestation. With the Prot renglypha where belong the dange out makes we have

grooved or canalized po son fangs attached anternally to the marnia Colubridae - The three series noted above belong to this very large family The notempore species belong either to the Hydrophinae (sea snakes) which have an celshaped (all and a rather flattened body or to the Elapuna (land snakes) which have a

round tail As a rule on anakes had in salt water near the shore but such snakes have been reported from a fresh water lake in the I hilippines. They are of importance in the tropics and are a source of dang r to fishermen While their venom is extremely toxic and their fangs ituated antenorly the dang r from them is minimized by their small heads and relatively melliquent b to The Elapmae have short trong fangs antenorly located and braind them small grov ved (not canalized) treth. The poison gland, which is the homologue of the parotid has a duct located in the upper lip and terminating in a parties. The poison duet does not enter the fane lumen but empty's into muscular folds which surround the base of the fang bence breaking off of a lang does not necessarily inture the duct. There is a succes ion of teeth in snakes so that a new lane grows out if the one pal one is extracted

Many of our harmless anakes such as the earter-snake and backsnake belong to the Colubridae

The cobras belong to the subfamil Elapinae and some are best known by a neck like expansion or bood. The only poisonous colubrate snakes in the United States are the beads; age (M crurus fule u) often called the Florida coral rake and the Sonoran coral (Muru order curyzon in) Both of these snakes were formerly included in the genus Elzps

The bradenake is bla k with about 17 broad ringson bands bordered with vellow Although small they are very venomous. The upper jaw has anteriorly grouved fangs which appendages are not present in the ron-poisonous coral nakes these latter having teeth in the upp r raw so that the wound shows a rows of punctures in tead of a rows and one larger puncture on each a de to mark the entrance of the langs

In Asia ther are many important poisenous colubrate anales the cobra (Vaja tribudiant) the king cobra (\oughtarrow businesses) and the kraits (Bungar is fasciatus)

All of the Austral an possenous snakes are colubrates

SHAKES OF THE UNITED STATES (STILES)

(4) Pupil of eye vertical pit present single row of ventral sca es po terior to the went adults with head more or less tria igular construction behind head more or less promusent Pet viners (all possonous)

(8) Pupil of eye circular pir ab ent doub e row of ventral sca es posterior to the vent () Color first hand on head black Corst snake (possonous)

(b) Color first band on had not back Fal e corals funt no sonous! fel tolle all other Not be sensus

Viperidae -The superine snakes are generally characterized by a broad head narrow neck short and stampy tail and a short upper jaw which with the lang is directed obliquily backward. The rattlesnake (Cratalus) the copperhead [4 noist of n con toriris) and the water moreasin (4 f scoreres) are widely distributed in the Un ted States

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Some di ide ile Vio rifae into the Crotalinae whi h possess the p t and the V per mae which do not have the structure Ru ell's v per (Dub sa russell) is one of the best known of the I perma and is one of the mo t amportant po sonous snakes of India The po son langs are grooved or perforated and connected with the poison clands

which esemble salivary glands and may be almost an inch in length in large snakes The tongue is slender and to ked and is a to t le organ

1532 REPTILLA

The laws are remarkable for their great extensibility, not only verti cally, but laterally, permitted by the ligamentous connections of the two halves of the mandible or lower saw

As the fangs are directed backward it is necessary for the snake when striking to open the jaws widely and bend back the neck

The langs are then brought forward
and erected by the spheno pterygoid muscles

The snake bite is a combination of bite and blow The functional fangs of colubrane anakes however are not mobile

In addition to the possession of the pit these sipers have a more or less triangular head and in particular a single row of large scales on the under surface postenor to the vent (anus) while the harmless snakes abow an elongated onal bead and two rows of large ventral scales posterior to the vent

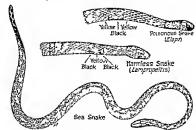


Fig. 385 - The possonous coral anales of the U S have transverse rings of black vermillion and yellow As different ating these anakes from harmless ones which reven ble them there are black rings bordered by two beliew ones while with the harmless snakes a yellow ring is border d by two black ones The sea snake (Enhydr no spec es) has a rudder like tail which is here shown twisted to one a de

Snake Venom -In examining the wound made by a snake the two punctures of the fangs indicate the bite of a poisonous snake. If these fang puncture points are far apart it shows that a large snake and prob ably one capable of injecting a greater amount of venom has given the bite

When a snake strikes the langs move from the honzontal to the erect position the mouth being widely open. When the langs enter the laws close and pressure is exerted on the poison glands so that the venom pours out

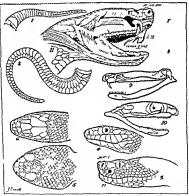
The idea that a snake exhausts its venom when striking is not true Colubrine snakes may bite shortly after the first attack and inject each time a lethal dose of venom Fresh venom varies from an almost coloriess fluid to one with a brownish or greenish color It is viscid and quickly decomposes from the varied bacterial flora it contains A number of years ago the injection of rattlesnake venom was used in the treatment of epilepsy but dangerous and even fatal reactions resulted from the patho genic anaerobes at times present in the venom of anakes Dried venom is quite stable in the dark and retains its toxicity for years

Dr M I Barnes points out that in v pers the venom gland I es between the abers of the maxillary and the sphene pterygoid muscles and the contration of the latter muscle in erecting the fang would also squeeze the venem gland and e

The amount of venom varies with the size and condition of the snake an adult cobra yielding about t cc. Acton and I nowles give the following table expressed in milk grams of desicated venom.

Common cohea (mean yield)	317 0 mg
Common krait (mean yield)	8 17 mg
Banded krast (mean yield)	64 4 mg
Russell a viner (mean yie'd)	108 0 mg

They estimate the minimum lethal do e fo man as 1,5 mg with cobra venom and 42 mg with the venom of Russell a viper (Dabois). The venom of the kizits is more potent that of the very .ommon ledian krait Bi ngarus cordidus being given as 1 mg



Fi 336 - I Sagi on o scales posterior to v mt (po quouses ke-wate mocca sin 2 do b) on cleast s thanno's snake (t v) 3 s de vi woth a lof proper 4 side even of ha do thannot snak 5 d nake woth served dorsal view of harm less snak 7 and 9 b 1 pu cour nd skall of Elaps 8 and s sam of harm! snake 11 p 300 app a tius of rathes ske

The cobra after having bitten rema is attached for a short time while the Dadosa strikes with the greatest rapidity and immed aftly releases itself

Cobra and krait bites (columnie snakes) produce more or less similar symptoms such as paralysis of articulation with nauses and vomiting and 1534 REPTILIA

later paralysis of the respiratory apparatus There is only an insignificant reaction at the point of bite

The venom is mainly neurotonic causing death by paralysis of cardiac and itsigns tory centers. Other venom is also very haemolytic. This haemolysis is actuated by the normal complement of the serum of the animal possoned the haemolyna is contained in the venom not being tone when alone activating the haemolytic substance in venom.

In rattlesnake bites (viperine snakes) there is marked pain at the site of the wound with much swelling and haemorrhagic infiltration. The

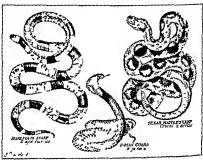


Fig 387 -Important pois nous anales

swelling and petechial mottling spread up the hinh from the point of entrance of the venom. Cold sweats, nausea cardiac depression and syncope are common. An exception to this general rule is Creolus terrificus whose venom is strongly neurotome affecting vis on and respiratory centres. The local effects are slight.

Rattlesnake venom is active chiefly on account of its haemorrham or rather endotheliolysis which de troys the endothelial lung of blood vessels

The haemolytic (haemotox) (lefters) of the venom of the Vest Indian and Co.Iris American vipers are most marked—haemorit ag a from the conjunctivate and somato-corinng along with refer vomiting. There is marked damage to the blood eard walls death occurring along with refer vomiting. There is marked damage to the blood eard walls death occurring in coma in about eight hours in the abora of a tween. From while such translation may be necessary. Of the tumenant pri upers the rattlemake venom is the most tonic and that of the water moccanin least so but the necrotic just power of the latter is more marked.

Ven ms may also contain proteolytic ferment, which may account for the softening of muscles in stake bite cases. The torue effect of the venom takes place without an appreciable incurbation period, beare different from the toxins.

The most venomous snakes seem to be the sea-snakes (Enhydrina). This venom

es almost entirely neurotoxic The tiger snake of Australia is almost equally venomous and the krait (B condidu)

next. The rattlesnake is about one fifth as venomous as the kra t. Clark (1042) in the identification of over 3 000 snakes esp cially from Henduras and Panama finds the commonest possonous snakes to be the f r de lan e Both ops alros B tonsberges and B natulus (hor noted mpers) B schleg lis fhorned palm viper) B latera s and B nterest this migromered a (both tree makes) B godmans B nummifera (jumping snakes) Lo hesis mi to (bushmaster) It is noted that Centalus f reshous s found in Panama Costa Rica and Colombia Dix aperies of the coral snakes were found particularly in Panama of which Micrurus negroes iclus prerocuicius was the most common

Certain venoms greatly increase the oagulability of the blood so that intravascular thromboses may occur It is chiefly with the venoms of Dob is and Bungarus that such thromboses are likely to occur and this a counts for the almo t instantaneous death which at I mes results from b tes of such anak a when the toxin is injected directly into

Treatment - The non-specific treatment of snake bite poisonir a which has usually been recommer ded is (1) Apply a tight highture above the s to of the bite for 20-30 min utes. The bigature which should pe ferably be a subber band is to b apple d'about a single hone extremity not about on with two supporting bones (2) carrying a mece of subber gauge is recommended which is cut and placed on the site of the bite buction by mouth should then be kept up steadily for at least one h if hour if no antivenin is available. If antivenin is at band it should be administered at a distance from the site of the bite and the suction continued. Less ion increases the chan e for the invasion of se ondary a fection

Bag smann has shown that a dog bitten by a cobra cannot be saved by fr a meision and the subbing in of permargapate crystals. It may however be saved by the imme duate injection of spice of a 5 per cent solution of permanganate but not if two minutes has clapsed B es from the Dabe o are fatal however the permanganate be applied He therefore does not con der the permanga ate trea next of any practical value Rogers thinks that Ban ermann a expension with does do not give a true idea of the value of permanganat because he has had success in experimenting with cats and because he believes it has eaved human lives. Chr. mi. acid ins ctions (a ner cent) have been recommended. Acton and Knowles consider potassium permanenate as unreliable and recommend sub utareous injections of a 5 pe cent solution of gold chloride These local injections are effica tous if u ed before the watern has been absorbed but they have no effect on venom taken up by the circulation. Intravenous injection of permangapate is not only without effect but is dangerou. Amoral states that the heature will not prevent the senom from spreading and may accentuate if a proteolytic and cytolytic action. In his opinion permanganate solutions in active concentrations have a deleterious action on tissues. Recent authorities counter indicate the use of potassum mapranate

Internally alcohol does not seem to be of any value in fact many of the deaths have been attributed to excessive ingration of whiskey. Strechnine in large almost poison our dozes was highly recommended in Australia but the statistics seem to make the

value of this remedy doubtful

In an article on snake bite A. Hamilton Fauley (1954) states that early free excision comb ned with mechanical suction in the only method of heal treatment hiely to be successful in body lates Immed ate application of a ligature and free excision (3 by 3 cm) down to the muscles was the only eff ctive local treatment in sheep bitten by tiger snakes He refers to the work of Commins (1927) advocating heature and incision combined with sucti n by a brea t pump and that of Jackson and Githens (1931) in which i ickion of the wound bite comb a d with act on by a Bier's apparatus and ite gation with salice is rec. minended. Fairles regards these methods as useful accessories to ligature lines on and exci. on. As regards the use of permanganate. Raymond. Ditmurs (Lecil a Medicine) states Nothing could be more fore gn to the treatment of anake bite than such practice. For local treatment be advocates deep incision and forced suction. Cauterisation should never be used

1536 LIZARDS

Allen (1230) particularly on account of the endences of local diffusion and local binding of the venom also does not recommend measures: He has discussed in detail all the local measures in the treatment of snake bute. He believes the use of an oclaim touringuet is harmful. The reason for this is because the poison is too isolvy absorded and destroyed and the circulatory stasss mercases the local necross and the consequent absorption of tonic tissue products. However, the thinks that the earliest possible varia on a lating ear and tissue may be beneficial. In still more deperate cases he points out that amputation is a more positive remedy. He also thinks that the touringet may be serviceable with or without refugeration as preliminary to delayed amputation.

Herbert Clark (1942) who has bad more than 30 year experience in Central Austra; in the study of venomous anakes and the trainest of ensist the emphasizes that treatment the essential measures to be effective should be taken immediately after the terror than the state of the terror than the sufficient of tournamer sufficiently tight to stop venous but not arternal flow, as advocated It should be relaxed for a few accords every to minuse Extraction of the venous by such calculated the started at once. Suction may be applied by the mouth over a this abert of robber laid over the bit. This should be continued vigorously for five minutes at the site should then be washed antivenene given and suction repeated. Incusing at the site of the bits are not advoced as the channels made by the florage array and additional incusions increase the raw surfaces and therefore basten absorption. Anti-most bound be given subevitanceasly and the tournament should be kept in position for a bour after the admitistration of an integer. Alcohol's contraindicated and per management cannot reach the dropters of venous hearts the start of the description of an integer.

In Central America antibothropic serum can be used with a good chance of effective ness in all cases though 80 to 85 per cent of the bites are due to species of Bothrops Duran Reynals (1939) has pointed out the spreading factor in certain snake venents

in relation to their mode of action

Antivening.—The active agents of snake venoms may be either of the nature of hemorrhagma neurotoms or fibre flements. In coulbrine snakes the neurotom vastly predominates whereas with the vupenies it is the haemorrhagm. Certain Antirahan snakes contain all three bodies in about equal proportion whereas with the ratile anakes of America it is almost eatirely the haemorrhagm which causes the postnoning The Micrurus (Elaps) of Florida is a colubrate snake and its venom is neurotone in nature.

The cause of death in echibence make hite is cheefly from parilying of the respiratory centers whereas with the pit upwess it is cheefly from hemorrhags in the vital organ Antitionian have been prepared against both vipenne and colubrine venous and these are specific this a colubrine antwent will not be of value against a openion has Antivenus should be administered either intravenously or intramuccharly. The amounts recommended for imprection to mertihade a faital does of anake poson viry from no to 300 cc. of the antivenius serious. There is no accurate method of standard ization.

When Calmette (1894) first produced antivenin the idea prevailed that it was useful for any snake venom a view soon found to be untenable. There are now institutes in many parts of the world where antiveams are made to combat the local venoms thus in the U.S. we have the Artivenne Institute of America which produces an antivenin for rattlesnake copperhead and water moccasin veoom. These venoms are chelly haemorrhagic Previously the toucity of some venoms made the immunization of horses precarious but methods of detoucation are now being used which are more successful. Both monovalent and polywalent sera are produced. Often when it is impossible to determine the species of the offending snake a polywalent serum is indicated. Antivenins are given either intramissicality or intravenously. With highly poisonous

venoms intravenous therapy is indicated. Fairley emphasizes that dosage is in inverse proportion to body weight so that children may require several times the amount of serum sufficient for a heavier adult. This is connected with the natural neutralizing power of the blood stream A large individual having more blood to partially neutralize venom than a smaller per on or a child requires less antivenin. Owing to varying strengths of antivenins (concentration methods) one should depend for dosage on the instructions accompanying the product. Besides the local and specific treatment for snake late one should put the patient at rest physically and mentally as psychical shock is an important matter with some snake lute patients. Fairley also recommends black coffee or caffein. Avoid stychnine and alcohol and in particular morphine

LIZARDS

Lizards are non poisonous with the exception of the two Gila monsters (Reloderma suspection and H horridium). The first is found in Arizona and New Merico (Gila niver valley) and the second named in south western Mexico. They are about 2 feet long heavily built and covered with small tubercles. The name monsters most appheable. The poison fangs are in the lower jaw and the late of these apparently sluggish creatures may cause death. The symptoms of poisoning often start with paralysis. Dyspinces and convulsions may follow. When aroused they are very victous and it is as difficult to open the closed jaws as in the case of a buildog. They lay parchment like ergs in the said of the desert

(For references see end of Chapter LH P 1440)

Chapter LII

POISONOUS ARTHROPODS, FISH AND COELENTERATES

VENOMOUS ARTHROPODS

Spiders —Spiders belong to the class Arachnida order Arancida There are numerous families divided into various genera. As a rule spiders secrete a venom which is capable of poisoning the small animals used as food but it is only in rate instances that the venom is poisonous for man. Individual idiosyncrasies may make one person susceptible to spider or other arthropod bites whereas others do not suffer.

Reports of illness following spider bites are very rare and many of these are due to secondary infections with progenic bacteria

The dread of spiders is probably connected with attributing the bystems of the Middle Ages or transitism to the bite of Leyess laranilas. As a matter of fact the bite of this spider produces only a localized crythema without general symptoms

Experiments have shown that most of the common spiders not only are unwilling to hite but even when almost forced to do so are unable to penetrate other than the most delicate human skin. Even then the bite has only the effect of a pin prick

In America we apply the term tarantula to a large dark hairy fero cious looking spider of the family of Aviculantidae None of these are dangerous in spite of folklore to the contrary (Barbour 1941) However certain species of the genus Latradectus produce systemic

However certain species of the genus Latrodectus produce systemic symptoms rather than local ones. A few are very poisonous

In southern Europe L tredesinguisties (the malmagnatte in New Zenhald Australia and the Philippines L breatful (thoon as the Laippo) and in North and South America L machine L cureacterist and L geometrics are common In Turks at L tredesing justifies (the Karakutt spader) in Australia frees relations (the funnaleweb spader) and in South Africa Latrodectus indistincties (the Kroppie spader) are much feared

The venom of the hospipe syder has recently been studied by Shapine and by Finlayson (1932) and its but is not at all uncommon in South Africa. The toan of the poison pland has been shown to be a powerful haemolysin. It has a marked depressant defect on the cardiac muscle. Rigidity and sparse of most of the muscles supervice especially those of the abdomen which become boardhic and the condition may must appendicular. Soluping of the skin in the neighborhooding my desired and the condition may must be appeared to the state of the same of the properties of the same that of the position of the direct body of the insect) differs somewhat from that of the pure venom of the former readily haemolyses human corpus cleas well as abose of the rabbit.

For treatment intravenous injections of calcium gluconate to cc of a oper cent solution has been recommended for the relief of pain and for decreasing the muscular spassm. Finlayson has prepared a serim which neutral zes the venom which he recom

mends for treatment

The bite of the species L kap to of New Zealand is said to cause slowing of the pulse and respirations and produ e tetanoid manifestations

Latrodectus Mactans — In the United States this species often called the black widow or houtglass spider has been held responsible for symptoms of poisoning in about 400 cases with a record of 16 deaths

These spiders have been reported from many states part cularly Western and South ern ones with about half of the cases from California This species bowever has also



Fig 388—Lai dat m t s fm ! (Blak wid w) Vental fac sh wing oa gerdhou gl sp t (O gn !) Appox mat ly actual e

ten found in southern Caraba, Cuba and Merco and as far south as Fern and Chile In also bods on entomology. Herma pres an e cellent descript on of it. The female is about an in h in frequent the male is much smaller. The globous abdomen of the female stands out fits a beautiful fighty polished block per il. She is exceedingly active and most aggressive. An interest up fact is her k ll ing the male after he has served the criss of sprency preservant.

It has been stated that the more hashands also has droposed of the greater the verities of her versor. This spader is usually found in 90 of set buildings. Chefry under privy seats or dry eracks in brack or concrete work supporting such he Idaings. There also can be found in mer houses and occupaed ones even in occupaed held. The web also can be found in mer houses and occupaed ones even in occupaed. The version consists of the properties of the properties of the properties of the properties of cocoon is attached to the web and register support of many up det web. The excocoon is attached to the web and register support of many up det web. The cocoon is attached to the web and register support of many up det web. The cotinuation of the company of the company of the company of the company of the cotinuation of the company o

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In southern Europe L treitementation (the molangmatte in New Zealand Australia and the Phalippenes L baselfo (thorn as also Raine) and in North Castella and the Phalippenes L baselfo (thorn as also Raine) and in North South America (the Castella Raine) and the Castella Raine (the Castella Raine) and the Castella Raine (the Castella Raine) and in South Africa Latrodectus and, in class (the Kroppie guider) are much feared

The venous of the Kroppie spider has recently been studied by Shapira and by Finlayson (1939) and its but as not at all uncommon m South Africa. The toun of the proposing flands has been shown to be a potential haemolysin. It has a marked depressant effect on the cardiac mustle. Righdly and spasm of most of the muscles supervised separably those of the abdomen when become beautifier and the condition may suralise apprendicutes. Sloughing of the skin in the neighborhood of the bite may occur. Pinals son has found that the haemolyte properties of authority of that is a solution of the dred body of the insect) differs somewhat from that of the pure venom. The former readily haemolyses human corpuscies as well as those of the rabbit.

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B quant citraties in the Egyptian Safan also gives in to a high mortality raching, do pricing in the property of individual states that the property of the pr

species of passes he does from an account entangle, we struck as consider contact.

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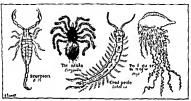


Fig 389 -Por on us arthropods and coclent rat s

The importance of scorpion poisoning has heen emphasized recently by Sergent (1938) in North Africa Basu (1939) in India Faust (1940) in northern Meuco and Shulov (1942) in Palestine The studies of Waterman (1938) emphasize the importance of poisoning by scorpions in Trimidad where however only the severe cases came under medical observation. The majority occur in the came fields of the occoa planta tons though the scorpions often lurk, in the shoes and clothing.

In 5 years at one bospital in the case growing district 650 cases were admitted. In the last year 150 and 35 deaths or 4 per cent. The failty rate is greatest in the very young. Of 16 under one year 6 ded but up to the age of 5 years in 53 cases there were 20 deaths. Twenty beep reft et all the cases occurred under 5. Between these were 150 cases at 05 deaths 2 per cent. In the second decade there were 150 cases
The symptoms are burning pains usually lessening in 15 minutes. The patient feels suck and presents salivation mause and comiting with profuse sweating. The comm may be dark coffee ground in color Respirations may be as rapid as the pulse, but though there is deyspaced, there is never cyanosis. Referes are increased. In inflants and children.

1540 SCORPIONS

the summer. The small grey spuderhags which hatch out in about a month are very scative. Mer several moits at each of which there is increasingly duker notor their develops after a number of months (and generally in the spring) a nature feasile with the deep orange spots on the ventral abdomen which enable one to identify this specie. The spots vary from a striking resemblance to an hourglass with the spots appet at their spince to an arrangement like a Maltess cross with 4 spots aft in bits it is. Again there may be only one spot. Cases of bits generally occur in the summer and sultime

W. If Chapman (1936) notes the severe systemic symptoms of four cases observed by him—ra their insignificant pain at the site of the little (which may not be manifest) to be followed in about 30 minutes by marked pain in vanious parts of the body particularly of the abdomen when the rigid muscles make one suspect acute abdomen

Hargreaves and MacKenzie (1942) have reported a case with such symptoms due

to the bites of L lugubris

The pain is excruciating and scarcely responds to morphine. The pulse is slow and the respiration embatrassed. The temperature may be raised and the leucocytes increased. There may be a macular rash Spasm of the back and thigh muscles may be noted. The venom is apparently a tovalbumin and its most damaging action is on the nerve endings, as in other poisoning.

For treatment hot packs may be of value. The administration of alcohol has been condemned. Gilbert and Stewart (1915) recommend intramuscular or even intra-enous injections of calcium gluconate (10 oc.

of a 10 per cent solution)

Injections of specific antivenin have also been employed. One such immune horserum is prepared by Mulford and Company. However, it is recommended that the patient should first be tested for serum sukness and if necessary desenatured between the intramuscular injection of the antivenin. Smith and D Amour (1939) have found that a most effective antiserum against the venom of the black widow upder has been produced in above 11 owner of 1840 to 1840 also produced in above 110 owner it is necessary to use a large number of spiders also also goo per sibere over a 6 months period. This preparation has been made commercially available by Squibb

Ma kinnon (1938) has found that the same species (L. medius) is found in Ura way where it gives rise to similar symptoms to those discs sed above. He report Acases in one of which a boy of 17 years was faitten in the subclavicular region. Death occurred in 30 hours. Another species of spoker (Cyptoronium guiteranthodius found in Petu gives rise by 15 to the op apprenous leasons becamture, and additional

symptoms as in Lairedeclus poisoning Its lute also may be fatal

Scorpions —These arachinds belong to the order Scorpionda The scorpions of temperate climates are usually small but those of the tropics may attain very large size even 7 inches in length —The last addominal segment terminates in a ventrally curved spine —This segment carries the poison elands.

Scorpions have formatable claws or pedapolics with which they sace their play and then by a down and movement of the total like abdomen they pures the party with the spine and this introduce their venous. The pot on of some of the large stor pions as Buthus quanquistraints seems to resemble in action that of the cobia venous Athough the larger scorpions are particularly to the directed or penalty wisters a sound children have been butten (mortality of butes at B quanquistraints in young children particularly soys) the effects of the butte of the mail scorpions found in the Southern U. S. and California are probably never fatal although they may be quite painful and produce slight general symposius.

Sampayo (1944) reports many hundred of cases in Buenos Aires Province Argentine frequently in tural laborers who with exposed chest handle hay or load cereal bags. He has wolated the venom which contains a neutrotoxic substance which has a diffuse excitatory action throughout the entire central pervous system.

As a rule the effects of a bee sting are entirely local but cases have been reported of general symptoms ensuing such as fever disziness dyspaces and urticarial lesions The symptoms generally disappear within a few hours. Howe er the introduction of the venom into the conjunctive is apt to give rise to more serious results the t saues quickly becoming greatly inflamed and oedematous sometimes with profound system c symptoms. In Liberta, the writer observed a native child stong by an enormous swarm of bees which succumbed quickly before it could be resiscitated

Recently the suggestion has been made that bees are not uncommonly associated with allergic reactions in persons sensitive to pollen and to other substances which the bees bring into close proximity to human beings and the term bee allergy has recently been discussed in medical literature

Some reports ha e been made that hypersensitized persons may die of shock from bee sting following previous sensitization. In some instances, the symptoms have d sappeared following the early administration of adrenalin. It has been suggested that such persons who are apt to be again exposed to the sting of bees should be desenst tized by injections of filtered extracts of the whole bee made up in Coca a solution to which phenol a a per cent is added

The bumble bee differs from the honey bee in that the sting is not cast of when stinging Jez Biske (1942) writes the effects of bee stings in East Africa appear to be very severe. Swarms may be met with on the roads which attack on a heroic scale. He estimates that one half dozen or more natives are killed by bees every year De the also occur in Europeans Wesk ammonia or washing soda is best for allsying the irritati n For wasp stings dilute acids such as wineger rather than alkalies are recommended

ifornets and wasps have a well diveloped sting and are more dreaded for their sting effect than bees. The sting of the masp is often very painful. If the stinging apparatus of the Hymenopiera has been left in the wound it is important that a should be removed with a sharp kn feblade or needle to prevent discharge of add tion I senom from the pois it reservoir. If the individu I has been stung by many wasps and system c shock occurs c rd ac and respiratory stimulants may be advisable. Local applications and warm packs may als be employed

It is of inte est to note the report of Pawlonsky and Sondak (936) that the wasp P I is sollious may serve as a disseminator of the erra of Asserts faculations and Trucksusphalu the infect on being carried about on the wings legs body and mouth

p to and n t in the d sestive tr ct

Ants -- In temperate regions ants rarely are considered as producing minry but in the tropics there are large formidable species which may not only cause local trutation but even produce general symptoms of nervous system involvement. The large ants of Central and northern South America particularly the tucaudeira (Paraponera clavata) are especially feared by the natives because of the very painful lesions which follow their stines

In parts of India and Africa the lessons produced by the tropical foraging ants of the genus Me omore m are of a very different nature bung produced by the bite of the ma dibles of their raws

In the Ph I ppines a me species of ants are prominent factors in destrying house

fly i r ac s that in this way they are of great assistance to man

Caterpillars .- C rtam caterpillars f various famil a of Lepidoptera (moths) have hairs with poison gland cells which irritate the skin produc g a more or less extensive r sb The cat reillars of the brown ta I moth have bars which when shed and coming in c ntact with the skin cause the be win tast ra h Allerenc reactions may be produced by venoms scales or other products of anthropods which may not generally be recogni d as po sonous-eczenius corvea or asthma

Beetles .- The best known of the urt cating (essenting) beetles is Lylla res cale to

the Sp mish fly the source of cantharadin which is most concentrated in the genitalia of the beetle. Other species of the family M leidae have similar properties. Certain species of the genus Pardreus or rere beetles, cont in a toric principle not cauth rad in

convulsions are common and in such cases the prognosis is bad. Extre tion may occur in poisonous amounts in the milk and Waterman observed a case in a woman stung shortly before nursing her child

Treatment formerly consisted of potassium permanganate administeria sixt venously but that has been given up. However some still recommend 2 cc of 0.5 per cent colloidal manganese intramuscularly repeated if necessary. Waterman suggested the administration of glucose to per cent exctally or 3 per cent subculsaeously followed by includin. The treatment otherwise should be symptomatic.

Antivenin treatment has been particularly recommended by a number of investigators. An antivenin made aith goats is available for the Brazilian form and is obtainable from the Serum Institute at Butanian Shulow and Sergent have also particularly recommended serum treatment in Asia and Africa.

Seggent has found the most dangerous species in North Africa to be Printers and sair size the reports antivaring treatment in gap patients (sp. children one old man is a dults) seriously all and thought to be dying. Of these so recovered and pide of children and one adult. In the case of 8 others (p. children and one adult in all of whoma fatal issue might be expected all recovered. Thus in a cases 34 ended in recovery 8 to pit cent. In 68 cases with mild symptoms all recovered to the control of
Mynapods —These arthropods are divided into the orders. Diployed or millipedes and Chilopoda or centipedes. Millipedes have an ore cylindrical body than centipedes and with the exception of the appendages coming from the most anterior somites have a pairs of legs to each sigment whereas the centipedes have only one pair to each sigment.

Millipedes have no fangs and it is generally accepted that they are harmless. However several species are of some medical naterest as species of Julius and Fontonia virginious; may serve as intermediate hosts for Himmological distinution.

Centipeden have posen plands at the base of the first pair of figst. The legs term intel as a poverful clave at the top of which in the opening for the regulation of the vention. The small centipeden which are found in temperate climates rarely give me for more than local symptoms but the large tropical one is not instance declarations. It is not instance declarations but the large trapical one is not instance declarations but the large trapical one is not instance declaration. The cause death in children by their stim. They give new to necessity of the acts of the two punctures and is addition may produce general symptoms of vontian in pheadcase fever and exent comes. For treatment local application of solutions of ammonia 1, 5 or 1 to are recommended. Hypadermic injections of morphia may be necessary to ally the pain.

Bees, Wasps and Ants —These arthropods belong to the order Hymen opters of the class Insects The venom of bees is ejected through the sting which is at the end of the abdomen In addition to the formic acid there is also a neurotomo in the venom Experimental immunicated tests suggest that bee poison is related to viper and rattlessale wenom (Phisslix) When a bee stings the stinging parts are usually left in the wound to continue by muscular action to force out the contained venom into the tissues of the victim

The only two important animal parasite infections with which the cailing of fish 1 connected are (1) Diphilobothrium latum and (2) Cloner chis strensis. The broad Russian tape worm is a rather common parasite of man in the Baltic provinces and comes from eating insufficiently salted pike and other fish infected with this larval lapse worm. The liver fishe disease of China and Japan is caused by eating various raw or insufficiently cooked fresh water fish. These fish are the secondary intermediate hosts the primary ones being mollises. A very small fluke of Japan Medgonieus robogonas is transmitted by the ingristion of certain goldfush.

There are certain this whose meat is purous an when there is no question of d composition and these in the fish. The best known pistance is with certain species of the period feed of the period. The illness produced by the earning of this fish is usually termed figurature. It alphanetic else packing such fish by the term fugur. The promoning principles seem to emit chiefly in the o airest and tester the entities of such it binarges on serious intention in a few munities or possibly death in a few hourset. It has been stated that after careful removal of all gential and alumentary trust organs thus fish may be extent without harm. The possionous principle has a plays objecting section somewhat I be cutter and it the rim stable. Such fish have been used particul lady in Ingain to communit or did not made and the community of the

Bosto rie (1940) has reported a cases in the Netherlands Indies in which the fi h identified as Telrodon argentees was cooked and eaten by 4 adults and 5 children. One

adult and one child ded within a hours of the onset of symptoms

The corewon fishes or D odontidae also are considered as poist nous. These fishes

togeth with the Tetraodontidae or broad need pullers are unuithly in appearance Among seamen they are generally des guated pull toods since they become distended with a ras it we are drawn out of the water. It is need recognized that certain of these fails which may fail to cause prosoning at one time may do so at another time and it is particully noted to be prisoning effects occur at the time of yawning.

In the tropics fish which may ordinably be safe as food become poison

ous as a result of feeding on certain poisonous medusae and corals

This is probably true of the barracids which is eaten with impunity at most times

Yet undoubted cases of postoning with its fish have occurred. It has all a been suggreted that the barracula may be postoning, and extend the real in its life for example during spawn ong or that it is subject to a more exped dec mostion at such times

To test reports of such possessing. Meedons and Itakanson (§ 6) reported the saming of barracing and with safety on sverial octs our Thin side as an ord those most comm mit prayells in the West Indian waters surrounding Fuerto Rico. The fish cates on exercit occasions streed from 8 to 8 pounds and one weight of pounds. One of the sain up from local inflarment we at that very 1 ree barracings were not rate. Fast in the same particular to the sain up from local for the case of the case of the case of the case of the productly couplet and cates barracing of the cost of Spanish It-order to the same in the requestly caught and cates barracing of the cost of Spanish It-order to the same fast of the case of Spanish It-order to the same fast of the case of the

there are two species of Miletto. In New Caledon 3. Wr c enous cau es painful cramps of the body with dyspaces, cyanor's colds we attuated dilated pupils and at times death M. Pro: so of the Next Indies is also a very po amous 5th.

Here describes in the Ph hpp he Journal of Science 1924 60 pec es of po sonous and worthless tishes of the ord 1 Flectognaths

Machi (1911) has in estigated the tox ceffects of fre h muscle juices it is 65 different are the of is in the United States the toxicity being shided by injections into mice are the systelyne the effect the juices had upon the growth of Lupiness abbus seed

Espec lly in Amazonia the carnero carderiù a lender f sh of the cathish family Pogid dae may bore into the urethrea of persons when bothing and cause severe bleeding. in their body fluids which on contact with the human skin causes an acute venering lesion which heals very slowly (Bequaert 1932 Roberts and Tonking 1936). Cet fain species of dung beetles may serve 22 an intermediate host of dean he ephila and Gantylonema.

Cone noted Bugs.—These have been discussed on page 11. (Instronucle). In bits of certain species of Retainer (lessing bugs) or Transons and page as a sector; ton of pulse and respiration and articists. Species of Retains (Consum) are noted for the seventy of their bits which is often attended with cellulates followed by the indication and possible septicaema. A species R begauther is found in the Wetter Duried States.

POISONOUS FISH

Fish Poisonous as Food - Hiness produced by eating decomposed fish, whether in the natural state or canned belongs to the general problem of

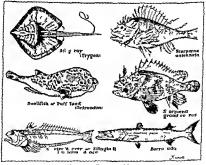


Fig 390 -Po sonous fishes

lood poisoning $\,$ There are however certain fish whose meat is poisonous when eaten in a perfectly fresh state

This may be connected with certain epidemic discuss a goog fast that are ordinarily harmless as food. A ratious hardcard organisms have been included from such fish and the purincipal of the properties of the p

Fish Which Poison by Their Sting or Bite—Fish of the genus *!Murarna have well developed teeth which are in relation to a poison sac which secretes a venom which is introduced into the wound made by the bite There are also various rays which are well known all over the world as canable of inflicting wounds.

In the sting 1935, Trygondae) the tail is armed on the upper side with a barbed sine which is none species to cannected with a point appearate. Some of these sting rays when wounding a person who may step in them while wading in the water may at the same time in culate testane bacill which are particularly dangerous because of the character of the deep punctured wound. In the electric rays, (Torpedinides) the donast surface is electrically posterize and the ventral one negative. To receive a shock one must communicate with the Tespoda species at two distinct points. Some of these electric rays are capable of temporarily paralyzing the arm of a man.

Two of the best known poisonous fish are Trachmus drace and Scorpones scrople. The fish of these fish is wholesome as load T drace is like a trout in appearance and has blue and brown stripes. It has a grown ell spine passing through each of its gill covers which is connected with a poison gland. There is also a poison apparatus connected with the dorsal fin. Strephas is an ugly red fish with a large head and prominent fins. The French fishermen call it. It diable. The poison apparatus is sconnected with the first there rays of the dorsal fin.

Persons in bathing who stake against three fine are more apit to be wounded than the fisherman who haddle the fish with cevt on Tollowing the wounding a person experiences stabling pains in the affected part. A sensation of sufficient on Islands with a state of the wound with the state may become definers of At times collapse and deals result. At the site of the wound we first have an erystem ious area which later becomes black and may become gangerous. As the positions rapidly exters the personal cruciation treatment similar to the local treatment of a six he has called for These fish seem to be more danaerous during the symptomy person.

A species S planuers (the lon 6sh) has been found by Bayley (1940) to frequent the shoals of the fine bathing beaches in Barlados where it hides in weed covered crevasses of the coral and bathers may be struck by its sharp apines or by stepping upon them. The poson impeted by the spines often gives rise to very severe as imptoms the patient usually being found withing in accorn vit evan beene commarable to that of renal color.

There is often profess perspiration the pienet being raile dyponent: and with severe tachycards. The pain is not local red. In the case of a loci the whole extremity may be partful. Vomit're accompanied by dat bors a feeping and after at hours a rain may app at For treatment to the economic ded that the area around they noture be militrated with a 2 per cent solution of procurse and it is no occurrent.

Echinoderms—Earle (1940) has reported upon poisoning from a variety of sea urchin found in Barbados and other West Indian islands. The pathological effects are of two classes punctures from the spines and the puthological effects following the riggstron of the ova

The species Tespecistes e c ! I s Bell (1878) is known as the white sea egg or edible sea egg. It inhabits g een scaweed and is captured by diving boys who carn a

lings. All the fish they found in their toxic group were regarded as medible except the catfish and the cel

Treatment—In all forms of fish poisoning after ingestion the most efficient treat most to immediately wash out the stomach and administer saline purgatives. The remaining treatment is symptomatic. Stimulants may be increasized to countered symptoms of shock and injections of morphine may in some instances be necessary to allowate the rain.

Barbour (1941) classifies poisonous fishes as follows

Spiny fishes secreting an irritant stime which is either generally distributed over the surface of the body or, more frequently, by glands survated at the base of highly developed spines which serve to inject the poison. The Sting Rays Tryon or Dasybatis are typical among Elaimobranch Scorpaena, Chilomysters and the fresh water cat fishes, such as Amounts are examples among Teleasts. In some of these the poison is very virulent. In other only slightly tritant.

ient In others only slightly irritant
In some fishes such as tluracus, the poisonous slime glands occur in
connection with the dentition. There are many species in this genus
In some there is a complicated poison of many ferments, virulent and with

divers effects

In other species poisoning follows the eating of the flesh. This causes a disease known in the Caribbean area as Ciguatera symptoms of which vary with the species and the susceptibility of the individual. There is

r Gastro enters. form the most frequent and benign. It may however result in death. With engastric pain headache cramps tenesmus muscular droopings names comming chilled extremities syncor and ergidings even desquamation.

2 Algade form very rapid after cating a possonous fish by reason of the immediate nervous symptoms afternate paralysis and consulsions cyanosis come and death

Of 2 many cases have been reported from New Caledonia after eating a local herring (Clupea tenenosa) and a toad fish (Tetrodon maculatum)

Treatment in any case is purely symptomatic in spite of many local

Treatment in any case is purely symptomatic in spire or many rose mostrum. One should empty the digestric tract, use emetics stomach washing, purgatives and enema. Apomorphine is useful. Sumulants should be employed to support the heart and to counteract the other symptoms of shock.

In many locality a there are local laws producting the sale of fishes kno va frequently to be pointeness. At \$1 Simens Bay South Africa shaps are notified on arrival to wate of the local Fenders. In Table Calpse affairs in producted b twen May and October. There are laws in Cuba and many other places prohibiting the sale of other species.

Venomosity appears in a sporadic and spontaneous manner in one genus and not in another of the same family or in one species and not in another of the same games to the modifical given the same condition of age time or year or sexual maturity

The principal cause rests in the metabolism of the fish sitell and is to be considered.

as the engageration of a normal function the torus function in pit to be considered as a pathologic phenom non but purely a concomitant of enumeration. The torusty is the most active a hen the sexual processes are most active) e darres

the breeding season For example the eggs are venomous in our pickerel

In man (the human being) puerperal manua or mana during pregnancy may be considered as offering examples of automatevication of a similar type

content than sea water. Firsh water musch have an economic value in the use of their shells for bottom making. Beades ill effects related to ideoporacisy possuma leading to paralysis or even death may occur. In California (1977) there were reported nor cases of mossip to soming with of deaths. The symptomes de choped in to to 20 mil utes after ingestion. The torin seems to be thermostable and is ab our everyth during the spawning asson (June through Septrabor). A few excess of possuming some of which aree fatal have been reported from the Ate water to present our to absorption from the possing about of Millianks expectally Conne gr 2 plan (the cone

POISONOUS COELENTERATES

In the phylum Coelenterata we find animals of very simple structure only the sponges and protozoa having a more lowly type. It is customary to distinguish two morphological types of coelenterates—the polyp and the mediusa

The Polyp -The best example of a poylp is a sea anemone

Quite inferesting in the study of amountly in the constant association of an anemone with certain benefit circle. The anemone cover the not tailed not of the carb time with certain benefit circle. The anemone to the total tailed of the carb time protecting the crub from staticts by its ensures. The mouths of the tos animals are in cheap attraction so that the food of the crub is abrind with the armonor. The rab acquires an immunity to the poison of the successor probably as the result of frequent ingent on of fragments of anemone. Other crubs are very sens twe to the amount poison suffering parity is and death. The poison of certain anemones may even harm other abremones.

A condition known as Is maladie des plongeurs occurs among the sponge fishermen of the Mediterranean This is due to singing by sponge fishermen of the Mediterranean This is due to singing by anemones and is characterized by marked itching burning and ery thems. In some cases the skin of the affected area becomes necroite and sloughs off leaving an uteer. Levin and Behrman (1941) in the West Indies have described Coral dermatistic from the Coral policy of the sense Actions.

Species of the genus ilitinion and Hellenopolypus may in addition to local lesions causes nause and comiting Applications of vinegar and of one of the order of the commended for its local symptoms

The Jellyfish (Medusa) - This umbrella like coelenterate has tenacles which hang down from the margin of the sellyfish

As a rule gilly fabre are harmless but certain species produce unpleasant or even sensors effects by their sting. Case of lessons following contact with unspecified jelly field. have been reported by Allen (1900) and Stevart (1917). The local rash in Allens scass wast flowed by produce verging exercises by aphona and by laryngits just ng for four works. Achi (1922 1023) portrays the severe effects besides utricoral pains again and the proposite sequelte stemation.

In the Mediterranean a jelly fish Rhi ordone philore produces oederna and urricanal eruptions as the result of its stung. In many parts of the tropics jelly fishes are found which give rise to quite scrious symptoms in the Philoppioes there are certain species of jelly fishes which cause ser ous tillness although as a rule one experiences no disconfiort from coming in contact with many other species while swimming in the waters of that nart of the world.

According to Light the aprenes of Bo Jyl met or call of fosforor by the natives is the most dangerous one there emountered. It has long ribbon 1 ke oral lappets and 24 stender white marginal testacles. So this the sting garofficied by permissiony to better living by its cultivation and sale. In size it may attain a diameter of a term and a height of 9 cm. The spines are short selender and sharp pointed and motor are white or whitsh. The owa are orange colored and he in sections issued the test which is brownib purple or sometimes, a deep greenish brown. The owa are regarded as a debtacy and may be eaten raw. They have a sweetish test like those of the Mediter rancane sea urthe. Usually however they are first bodied and then fined.

The spines of the red sea mechan described by Castellam and Chalmers are posso out and in this species they only cause trouble it allowed to remain six six in the puzz tured wound usually austrained in the hand of those who collect them or on the feet in bathers. As the sea egg is not an every day article of food allergic reactions may follow its ingestion consisting of abdominal symptoms including epigastic disconfict pure nausea womiting and distributed. Urticans varying in extent is allo known and may follow the ingestion of fresh or cooked own. Aside from allerge reactions disestive disturbances may arise in specially susceptible individuals with whom they stem immediately to disagree.

A second species known as the black sea nrchin (Centrechinus antillarum Clark (1918) harp spines with small barbs along the entire length and hence it is difficult to remote them and some prefer to apply antiseptic processes and wait until suppuration

occurs The ova of this species are not eaten

MOLLUSCS AND DISEASE

The importance of disease transmission by snails has been taken up under the helminthic infections caused by flukes

Oysters —There are more than 300 species of true oysters (Outree) exclusive of various allied forms such as the pearl oyster or the window pane oyster. Oysten belong to the class Lamelibranchs and the two most important childs expect and O estigate the European oyster and O estigates the European oyster and O estigates the America Canadian one. The quest ton often ancies as to the edibitity of oysters which are green in Coor. This cloris considered desirable in certain European countries and may be produced in France by feeding the Oysters a diation. Amende streams. The green pigennic it present in the gills and palps. Such greening may be natural. Sometimes there is a green color of the body of the Oyster due to copper.

Typhoid Feter and Oysters—There have been numerous outbreaks of typhoid fever in both the United States and England for which the eating of contaminated oysters was responsible. Oysters may be contaminated when growing in sewage contaminated beds but in the studies of typhoid infection from eating raw oysters the blaime has been placed on polluted water used for floating oysters. If the water in which the oysters are placed for storage (floating) is pure such a process makes the oyster safe At present floating in chlorinated see water is of particular sanitary advantage. Outbreaks of typhoid fever as for instance that of the N typidemic of 1924-1925 when more than too deaths from typhoid fever were recorded have led to official regulation. In uncontaminated salt water studies have shown that the oyster gets rid of the typhoid organism from two to three weeks.

It is probable that the only ground for considering a sound syster as capable of causing food poisoning is from its effect on individuals with an idiosyncrasy to shell fish—and such idiosyncrasy seems not uncommon

Mussels —These all o belong to the class Lamellibranchia. Mussels are widely distributed and in Europe form an important article of food (the edible mussel. Mythiss edulis). They seem to thrive better in saline waters which have a somewhat lesser salt.

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in the four long ribbon like oral palps. Lobeniums called by the natures lantered is of large size white or white and purple in color and stings by the long filament which arise from the mouth areas. Stitt treated a number of cases of gelly this stop ing in the Phillippines which presented symptoms ranging from a mild cythem at those showing marked congestion of the repurstancy fract and other enemal symmetry.

Old has described these symptoms very accurately and notes the following

The symptoms appear in from ten to sixty minutes with marked bys terical manifestations incessant cough and cory all signs. Light believes that the cases described by Old were due to stinging by Dadylomita.

Used describes his own experience with a relly fish sting while so imming in Mindle Bay. The fitted six became rerapped about the upper arm and statenge as institutions as the tentacles did not thing. The proof and acceled the conjunctial of other mucous membrane. There was at once a sensation of busing in the area of our tack but it was a sensation of busing in the area of our tack but it was a sensation of busing in the area of our tack but it was a sensation of busing in the area of the core and the sortium. This was followed by a curroun restlessness and was ness then a sense of construction in the throat with cheef discomfort and then corpus and lackly maintow. The symptoms a thated and within an hour there only transit weakness and sortness of the bronch. A vescular dermatitis appeared on the arm and the traces of the sturp had not disappeared after a or a week.

Other cases have been reported associated with feelile heart action and semi conscious states. There is always to be considered the possibility of one 3 drowing when in the emotional or semi conscious state. Wade describes a death in a robust Filipino who was stung on the leg. His companions were only a few jards away hut by the time they had reached him he had collapsed and was gasping and livid and was dead a few moments later. It was at first thought he had been bitten by sees a seake but there was no mark on the leg except conspicuous purplish discolaration. On autopsy he showed status lymphaticus with persistent thy mus acute congestion of the viscera and oedema of the lungs.

The Pottuguese man-of war (Parsoles) has long botomotive tentacles which stretch out from 30 to 50 feet as the animal is blown along by its pearly purple created bladder like float or asal. The thread cells are capable of indicting rather panulul stamps when handled without a knowledge of the effect of coming in contact with three thread cells along the rotant of earliers [Binds there are concasons who means were more as when of a smill.

Along the coast of eastern Florida there are occasions as ben great swarms of a small very dark brown Usdaisa occus near the shore. These are about the size of a shallon owe called Linuxde surpsicioda. It was formedly better known as Linuxge. This spaces is so abundant that very severe stinging occasionally occurs the symptoms being smulier to those described above.

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TABLE OF IMPORTANT ANIMAL PARASITE DISEASES DISEASES CAUSED BY PROTOZOA I trud t

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Chapter LIII

TABLE OF IMPORTANT ANIMAL PARASITE DISEASES

CLASSIPIPATION OF ANICHE PARASITES. (According to Stiles)

Protozoa

Eunematoda

s Unicellular animals (nithout tissues) as the parasites of malaria

in intestine of man hair snakes or horse hair norms Intestine present lateral chords present parasitic in intestine muscles lymphat

ics etc very common and important roundworms 7 Six legs present in adult wings present in most species larve annulated much like an earthworm breathe through traches adults ectoparasites occasionally larva is parasitic under ship or in nounds or an accidental parasite in the

intestine or bladder insects

Pluncellular animals (with tissues) metazoa 2 Body more or less Cattened dorso ventrally Body ordinarily found in transacrise section 3 Body never annulated never provided with legs jams absent

	trachest system adults with jointed legs or other appendages
4	Intestine but no arms present one or two suckers present body not segmented parasitie in liver lungs blood intestine occasionally elsewhere flukes. Tremated.
	Intestine absent two or four suckers on head body of adults segmented issue usually contains calcareous corpuscles adults (Lapersoms) parantics a niest into laware (bindder worms) parasitue between the latestine and away priesent sucker on porterior and body annulated like an earth worm parasitue to upper an passager or extendally letches blood suckers
5	Hirudnes Intestine absent armed rostellum present very rore in man in intestine there
	headed worms Acanthocephala Intestine present no armed rostellum Rematoda 6
6	Intestine rudimentary in adults lateral chords absent fare accidental parasites

Eight legs present in adult six legs in larva, head and abdomen coalesced, ecto. parasites some burrow under the skin or live in the hair follicles acannes Acarina Four claws around the mouth larva encysted in various organs adult occasion

Languatulidae ally parasitic in nasal passages tongue worms Numerous legs present occasionally accidental parasites in nasal passages or intes Mynapoda ting thousand legetra

HELMINIMC DISEASES-TREMATORES

Pratè	Dā hot	Figured at biss	Emportant ser or of virus	Tr ms d pth g city
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DISEASES CAUSED BY PARASITES FORMERLY CONSIDERED PROTOZOA

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HELMINTERC DISEASES-NEWATORES

TABLE OF IMPORTANT ANIMAL PARASITE DISEASES

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ARTHROPODAN DISEASES -(Cont nued)

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SECTION VIII

GENERAL AND STATISTICAL CONSIDERATIONS

Chapter LIV

PROBLEMS OF MEDICAL PRACTICE IN THE TROPICS COSMOPOLITAN DISEASES IN THE TROPICS

In the diagnosis of infectious processes in temperate climates one often keeps in mind syphilis tuberculosis and the pyogenic infections when the diagnosis is in question. In the tropics these conditions are just as common and added to them we encounter many other diseases with protean manifestations as in malaria beriberi leprosy ancylostomiasis and other helminthie infections pellagra and amoebiasis

A common mistake that may be made by the physician when he first arrives in a tropical country is to expect to deal chiefly with diseases designated tropical Before going to any tropical country a most important preparation is the study of statistical reports from that section covering a number of years. However such records are often not to be found Everyone taking up the study of tropical disease should study the geographical distribution of such diseases and those practising in temperate elimates should remember that one of the first questions to be asked a man suspected of having a tropical disease is. Where have you been during the past months and years? Then too it is often advisable to apply the same question to intimate associates of the nationt

While a medical man is apt to have superabundant energy during the first few months of his tropical service this later may give way to the opposite state and in particular to a lack of initiative. It may be possible to do that which is absolutely demanded in the daily work but one may feel that beyond the lines of routine requirements it is difficult to under take new investigations and the more difficult procedures for diagnosis

Consequently while in possession of full energy and zeal one should formulate a method or system of history taking and physical examination applicable to the diseases prevalent in the country in which he is working and make this a routine procedure

The close observer will note at a glance such obvious choical manifestations as skin pigmentation eruptions ulcers malformations, emacia 1566



and popular ideas as to nature and causation of disease. When employing a native interpreter it is always well to keep in mind the fact that such assistants will rarely admit of ignorance of the language to the medical man and furthermore they try to twist the answers of the patients to make them agree with what they may thank is in accordance with the desire of the examiner. In many parts of the tropies the history obtained from the patient in regard to his age is often very untrustworthy. Again in carrying out the physical examination it is difficult to be certain that the findings as to location or degree of pain sensations or time of appearance of lesions as well as data as to pulmonary, renal and alimentary trent disorders are correct.

It is not difficult in some localities to train a native helper to make and stain correctly good blood films as well as to examine such preparations and the same holds for preparations of the urine and facces. The skill in making preparations the familiarity with pathological findings and the patience in studying a preparation on the part of these assistants is at times a matter of surprise. In regard to the intelligent and reliable examination of such preparations it is advisable for the physician to confirm the diagnosis himself by having the native attendant demonstrate any parasites he may encounter.

It has been emphasized that tropical diseases do not necessarily predominate in most tropical countries. Many important infectious diseases are characterized by their cosmopolitan nature. The prevalence

of some of these is often modified by a tropical environment.

Suit made a valuable statistical study of the cases reported from the hospitals of the United Fruit Company located in Cuba Jamaica. Colom bia Panama. Costa kica and Honduras. In order to contrast disease prevalence in the tropical prito the new noted with that of the Orient, he selected the figures of the Philippine General Hospital as affording statis tics which may be accepted as particularly tetable in view of exceptional opportunities for accuracy in diagnosis afforded that hospital by reason of its closs affidiation with the Philippine Brugau of Science.

The statistical reports recorded in the table of the cases of the hospitals of the United Fruit Company are for the year 1927 and in the returns of the Philippine Ceneral Hospital for the year 1924

The United Foul Company in 1877 employed in its tropical stations approximately 2000 white persons and 52 500 colored persons. Including members of families and non employees the medical department had supervision over or direct contact with 140 400 persons. During the 267 2675 glatients were treated in its hospitals and 150 850, in hospital dispensances. Including ho pitals dispensaries and field dispensaries 38/117 persons were treated during the year. The death rate among white employees was 565 per thousand and for colored employees 988 per thousand.

According to these statistics pneumonia diseases of the heart and arteries tuberculosis cancer and acute and thronic nephritis were among the chief causes of death. In normal labor no death occurred in 368

tion dyspnoea and many other outstanding signs of disease. Logical deduction from such observations will often suggest the proper laboratory procedures to follow in order to make an accurate diagnosis.

The general examination of the patient may be based upon the ana tomical plan examining one portion of the body at a time or the physic logical examination of the nigans by systems. Either plan should be followed by a more detailed examination of the system or part of the body which seems to be principally at fault. After such an examination one is in a position intelligently to outline definite laboratory procedures. The accumulated evidence obtained by observation history physical examination and laboratory data is then considered and a provisional diagnosis arrived at Diagnosis will be confirmed or denied by further study, additional laboratory and or progress of the patient. There are many pitfalls in the way of the diagnostician in the tropics and one should approach each new patient with an open mind and especially guard against becoming possessed of fixed ideas or the making of sand diagnosis.

We all know how difficult it is in temperate climates at times to find definite pathological conditions in people who complain of illness and yet who are apparently well. In such patients a definite finding of a cause sufficient to account for an illness is usually the key to the diagnosis With those from the tropics however it may be different. Thus a single individual exceptionally may be found upon examination to have amore biasis, malaria faliariasis and syphilis yet none of these infections may prevent him from following his usual occupation. When such a patient enters a hospital ward it requires a correlating mind to eliminate four or five definite diseases, and to recognize in addition some diseases which is also existent and common to both tropics and temperate climates as for example typhoid fever

In diagnosis in the tropics it is important to have a knowledge of the various physical signs and subjective symptoms more or less character isten of every disease of man as well as of the procedures necessary for laboratory diagnosis. Often it is only when one has assembled all obtainable information that the solution of the medical problem becomes possible.

Furthermore it is necessary to be familiar with the fact that certain infections, which at times give rise to marked alterations in the health of a patient may at other times and in particular when different races of man are concerned give rise to no recognizable interference with health This is particularly true of certain helmorthological diseases as for instance the slight effects often noted in hookworm infection in the African races as against the marked damage to those of the white race harboning such parasites

We do not always fully appreciate the assistance the history of the present illness as well as personal and family history of a patient may give us although it is generally recognized as the first line of approach in diagnosis. In the tropics when dealing with natives we may have the difficulty of language to contend with as well as with native superstition.

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cases in the United Fruit Company's hospitals and but in 3 in 1574 cases at the Philippine General Hospital

Notable among diseases important from an economic standpoint are veneral diseases, malaria, filariase 3 jaws and hookworm infections which have a distinct bearing upon mortality rates without being a direct cause of death. The annual mortality rate among the immates of Bilbid Prison in Manila was reduced from about 238 per thousand to about 75 per thousand by general sanitary measures. After the pissoners began to be systematically treated for intestinal worms, the death rate was further reduced to 13.5 per thousand (Heiser, 1908). However this reduction was not alone due to the removal of the heliunthic infections but to other general sanitary improvements made in the prison life improved diet, etc.

In connection with the statistics of the Philippine General Hospital it should be mentioned that cases of leprosy, cholera plague and small por in Manila were sent to special bospitals for these diseases and not to the Philippine General Hospital The number of cases in any year of such diseases as cholera or plague would depend upon the size of an outbreak or epidemic.

In the table above it may be noted that no case of searle fewer was recorded. Diphtheria measles and cerebrosponal fever while showing a preference for cold weather, prevail in tropical as well as temperate climates. It is interesting to note that no case of pellagra was reported by the Philippine General Hospital and that while fewer cases of bendern were treated in the United Fruit Company's hospitals the disease was present in both localities.

Choisser working in Haiti found that in 300 autopsies tuberculous was found to be the cause of death in 90 cases syphils in 9 and cancer in 7 Of 210 patients coming from all parts of the Island during 1927 cancer was found in 38

A few of the important cosmopolitan diseases are referred to alpha betically below

Almentary Tract—Acute appendicus in Indians bath among Moslems and Huidea has been reported as executingly rate. Manous Blart (raps) has zero only a cases in an expenence of over 30 years. He also emphasizes that indiammation of the appendix is rare in native races, generally and that Indiamating cases requiring immediate operation soldom occur in marked contrast to the frequency in European rendents. On the other hand the statistics given in the table show yes cases in Central America and rars cases in Mamila the greater proportion in natives. Probably the great majority of unitives in the tropic septembly those living in rard communities who siffer statistics of appendictus either recover or succumb without ever applying to a physician or surgeon for treatment.

The occurrence of appendicuss in connection with belianthic infections is referred to in the chapter XLIII on cosmopolitan nematodes and in the chapter on schistosomissis YLVII

Gastric Ulter —DeLangen (1936) has collected statistics showing the rarry of gastric ulcers among the natives in some countries. As a result of 1770 autopsies. Kouwenaar came to the conclusion that ulcers of the

stomach and duodenum are found in only 1 per cent of the male Javanese and o of per cent of the female against to I per cent amongst the Chinese and 5 6 per cent amongst the klings Bonne in 1318 autopsies on natives in Netherland India found gastric uters only 5 times (037%) and duodenal uters only 8 times (063%). Of the 5 patients with gastric ulcers 4 were suffering at the same time from a severe grade of tuberculosis and the appearance of the ulcers led one to think that they might also have been tuberculous in origin. Among 541 autopsies of Chinese in the same period of time gastric ulcers were found 16 times that is a per centage of 3 per cent which figure agrees with some of the figures found in European statistics

Castellani reports in his book that in his years of practice in various parts of the tropics he only saw z cases of gastric ulcer among the native races McGarrison in Hunza in the Himalayas never saw a single sufferer from pastric ulcer. In Bengal on the other hand in other words in the heart of tropical British India many sufferers with gastric ulcers are met

with according to Houston

Pel in Egypt seldom observed gastric ulcers From the annual reports of South Africa it would appear that gastric ulcer is also quite infrequent among the coloured races of that part of the world The same applies to the Belgian Congo On the other hand reports from Aby sinia show that this di ease is by no means uncommon there while the same is reported of several negro races living in the high plateaus of Central Africa In China the reports of Vortisch and of certain missionary doctors in South China and of Fischer indicate that gastrie ulcer is very rare in that country. On the other hand Oppenheim in 100 autopsies in Hongkong found gastric ulcers in times. In Central America in one year there were 31 cases of ulcer of the stomach and duodenum and in Mamia 86

Other reports show that this condition may or may not be common The reason for its prevalence to some areas is not clear but some of the evidence presented suggests that at does not apparently depend upon the grade of gastric acidity although dietetic causes have been suggested A simple carbohydrate diet does not predispose to it

Corcinoma of the Stomach - Malignant growths of the stomach and other

parts of the alimentary tract except in the cases of rectal billiargiasis p 1410 are rare in natives DeLangen who has made a special study of the subject emphasizes its rarity in the Javanese Reports from fredia and from Central Africa also indicate it is rare. On the other hand, the prevalence of primary carcinoma of the liver is emphasized in both the East Indies and among the negroes in parts of Africa

Allergic Diseases -The importance of food allergy in the diagnosis of clinical transfestations should be recognized. Beside the reaction from certain foods there are many other causes such as pollens animal emana tions including feathers and hairs smoke and dust bacteria especially of the respirators group and response to the injection of foreign proteins whether sera for therapeutic use or by inoculation by biting arthropods

There also seem to be contributory factors such as dysfunction of the endocrine glands emotional states, heat light and cold The symptoms of allergy or idiosyncrasy, as it is often termed extend from a fatal shock ushered in with severe pain of head and back rapidly falling blood pressure and collapse, to mild attacks of erythema, urticaria or asthma Nasal pharyngeal, laryngeal and gastrointestinal symptoms also may be noted as well as arthritic attacks angioneurotic oedema and eosinophilia

The influence of heat and light is often more intense in the tropics than in temperate climates especially that of light, and the photo dynamic qualities of many fluorescent substances may be very toric or tend to produce afteration in enzyme action under the influence of sunlight Allergic disturbances have been more commonly observed among Euro peans residing in tropical countries than in natives. One of the best known of the allergic states is that associated with serum sickness, where after about 8 days as a minimum following the injection of a therapeutic serum, there may be the development of fever, urticaria, hypotension and tenderness and stiffness of the joints Stitt suggests that the early symptoms of Japanese bilharziasis may be of this nature see p 1680

Anaemia as a clinical feature is observed almost everywhere in tropical countries In addition to the anaemia which is so prevalent in the tropics from severe malaria and ancylostomiasis and which also occurs in Bar tonella infection and sometimes in association with Diphyllobothrium latum and in the deficiency disease sprue practically all other forms of anaemia which have been described in temperate climates may be encountered The forms of anaemia resulting from specific conditions have been discussed generally under each disease However on account of the special importance of the subject in the tropics a brief statement regarding the classification and different forms of annemia is here deemed advisable

Classification - Statt Clough and Clough (1938) have pointed out that there is no single acheme of classification of the anaemies which is comprehensive and satisfactory The most logical method is based on the pathogenesis of the anaemia (1) Those due to loss of blood the posthaemorrhagic anaenuas (2) Those due to inadequate blood formation the deficiency anaemias and the aplastic anaemias (3) Those due to increased blood destruction the haemolytic antemias There are practical difficulties in the application of this classification because in many cases inadequate blood formation Nevertheless this method and increased blood destruction both play an important role has been utilized as far as practicable in the following discussion

From the morphological standpoint the americas may be classified according to the mean corpuscular haemoglobin or color index as hyperchromic normochromic or hypochromic and according to the mean corpuscular volume or volume index as macro cytic (megalocytic) normocytic or microcyti. This classification has practical significance since in general macrocytic anaemias are benefited by liver or liver extract whereas the hypochromic anaemias are belped by iron. The terms bowever should be regarded as descriptive and not as diagnostic. The terms normocytic and normochromic should be understood to mean merely that the average volume or haemoglobin content of the red cells is within normal limits Otherwise they may be misleading since the cells may be abnormal in other respects and individual cells may he markedly abnormal in size and col r

The current tendency is to drop the use of the old terms primary ansemia supposedly due to some inherent disease of the blood forming tissues and secondary anaemia due to some obvious extraneous cause

The following classification and description of the Anaemias with very few additions is given by Stitt Clough and Clough

A ANAEMIAS DUE TO LOSS OF BLOOD

These anaemias are hypochromic and usually microcytic

I Acute Posthaemorrhagic Anaemia -- The danger to life from a single profuse haemorrhage is from circulatory failure (shock) due to the lack of a sufficient volume of blood to fill the vessels and not from a deficiency of haemoglobin The first step in regeneration after an acute haemorrhage is the restoration of plasma volume by the passage of tissue fluids into the vessels. This results in a dilution of the blood with a gradual fall in red cell count and haemoglobin which is not complete until from 24 hours to 2 or a days after bleeding has ceased. The resulting anaemia stimulates a rapid production and outpouring of new red cells which at first are normal reticulocytes. After a few days however the new cells tend to be imperfectly formed to be madequately supplied with baemonlobin and to be hurried into the circulation before development (maturation) is complete. Reticulocytes are increased polychromato philic cells appear and occasionally a few normoblasts. There is usually a neutrophilic leucocytosis and an increase in platelets Many of the new red cells are smaller than normal and are pale. The color index and volume index fall. With the influx of new cells there is a gradual rise in the red cell count and (more gradual) in haemoglobin. The maximum abnormalities in the cells however are not reached until about the eighth or tenth day. In otherwise normal individuals completely normal conditions are restored usually after about 30 to 60 days

2 Chrome Posthaemorrhage Anaemia —The changes in the blood are usually similar to those described above but they tend to become more marked. In severe cases there is a marked degree of anisocytosis a majority of the red cells are smaller than normal in dia meter and volume microcytes are numerous and some postsiocytes may be present. As the iron stores of the body become depleted the concentration of haemoglobin in the cells dimmashes the color index and the saturation index fall and the cells are pale. The centers may be colorless so that the cells look like ingaş (pessaya forms). There is no increase in the birubin in the serum. This is the typical picture of a hypochromic microcytic anaemia. The degree of anaemia may be severe. Counts of a million red cells and sor⁶, of haemoglobin are not unusual and rarely, they may fall to half these figures.

The bone marr was byp splastic and the pt d minant cells are normoblasts. The latty mar ow of the tibuand other long bones is often replaced by such red hyperplastic

While act of matten of r leells of thomas manufacture rells will be present. In case with protested felecting however the marrow may become extensive displaced in such cases it immatter red cells desappear and there may be a reduction in the number of leekes/era and pictosts. In exceptional cases of this type particularly those with long continued small harmorphages the few cells which are formed may be more nearly normal and the color under may approach to

Identical changes are met with in hockworm a f clien

There also seem to be contributory factors such as dysimetion of the endocrine glands emotional states heat light and cold. The symptom of alletgy or idiosyncrasy, as it is often termed extend from a fatishock, ushered in with severe pain of head and back rapidly falling blobal pressure and collapse to mid attacks, of crythema uniteration or stables. Nasal, pharyngeal laryngeal and gastrounte-turn! 53 mptoms also may be noted as well as arthritis ettacks, augmoneurotic codequa and cosnophia

The influence of heat and light is often more intense in the tropics than in temperate climates, especially that of light and the photo dynamic qualities of many fluorescent substances may be very toxic or tend to produce alteration in enzyme action under the influence of similght Allergic disturbances have been more commonly observed among Europeans residing in tropical countries than in natives. One of the best known of the afferinge states is that associated with berum sickness where after about 8 days as a minimum following the injection of a therapeute serum there may be the development of fever, urticana, hypotension and cenderness and stiffness of the joints. Stiff suggests that the early symptoms of Japanese bilibarians may be of this nature seep 1580.

Anaemia as a clinical feature is observed almost everywhere in tropical countries. In addition to the anaemia which is so prevalent in the tropica from severe malaria and ancylostomiasis and which also occurs in Bar tonella infection and sometimes in association with Diphillobahrum slama din the deficiency disease sprie practically all other forms of namema which have been described in temperate chinates may be encountered. The forms of anaemia resulting from specific conditions have been discussed generally under each disease. However on account of the special importance of the subject in the tropics a bird statement regarding the classification and different forms of anaemia is here decemed advisable

From the encybedyred standpoint the anxenian may be classifed according to the mean compuscial bateneglobis or color index as hyperchronic normochronic or bytechronics and according to the mean acceptancial color of the color

The current tendency is to drop the use of the old terms primary anaemis suppo edly due to some inherent disease of the blood forming tissues and secondary

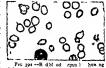
ansemis, due to some obvious extraneous cause

about 60% Mucus is abundant. The ordinary ferments are often diminished or absent but the intrinsic factor of Castle is retained

The Mood shows all the features characteristic of a hypochronic microcytic anaema as described in posthaemorthagic anaema. In the average patient the red cell count is between 35 and 40 million the haemoglobin of to 8 Gm or 40 to 50%. In severe cases they may fall to 15 million and 20 Gm. The striking leature is the extreme pallor of the cells and the degree of reduction in the volor index (63) and in the mean haemoglobio content (110) and the red cells which may develop. The leukocytes and platelets are usually normal.

In untreated cases retrulocytes are spruse. However biops, shows the bone marror v to be markedly hyperplastic (normoblastic). There appears to be some obstacle to the maturation of the cells. An effective stimulus to their maturation and delivery, into the circulation is provided by the administration (by mouth) of large doses of 100 f 6 m or more per day of ferri et ammoni citras or correspondingly large doses in terms

of their metallic ion content of the metallic ion content of their perparations. In severe cases within 3 or 4 days after an adequate done of iron is started there is a rise in editories started there is a rise in editories which is roughly invest by proportional to the haemoglobin percentage. A satis invest by proportional to the haemoglobin percentage. A satis factor response is indicated by a rise in retuilior; is to \$7\% if the Hb is 40\% and by an Average daily rise in \$7\%.



Fro 398 -- R dbl od rpus l how ng defices ha m g b n (s b m) F om a well marked cas of hlor is Ringhts tan (x70) (J C Todd Chn al D gn)

of at least **\(^2\) (in some cases 2*\(^2\)). An equally striking rise may be obtained in severe hypochronic anaemia of other types as in hookwing manaemia (Castle and Rhoder 1932) and even (temportarly) in cancer of the stomach. There is prompt relief (not always complete) of the symptoms and subsidence of the physical signs except that the lingual atrophy and the achierhydran persist. Liver extracts are ineffective

The discas is rarely directly fatal even if untreated but it often causes a protracted and profou d degree of chronic invald in. There is little tendency to spontaneous remi ion until fire the menopouse. An exacerbation may be precipitated by a present ny or by intercurrent infections.

B ANAEMIAS DUE TO INADEQUATE BLOOD FORMATION

a Angemias Related to a Deficiency of Iron

These anaemias are hypochromic and usually microcytic in type They include (1) Anaemias due to lack of eron in the diet seen most frequently in infants and young children on a diet consisting largely or exclusively of milk. The anaemia appears earlier and is more severe in children of anaemic mothers because of inadequate storage of iron in the foetal tissues

- (2) Anaemias due to fault, absorption of from from the directive tract, as in chronic diarrhoea cohiis and some cases of sprue and indiopathic steatorrhoea
- (3) Anaemias due to loss of iron by external haemorrhage (alread) discussed)
 - (4) Anaemia in severe hookworm infection
 - (5) Angemia in some cases of cancer of the stomach
 - (6) Anaemia in some cases after extensive operations on the stomach
 - (7) Idiopathic hypochromic anaemia
 - (8) Chlorosis

Idiopathic hypochromic anaemia (primary microcytic anaemia, simple achlorhy dric anaemia chronic chlorosis) is a chronic disease largely (95%) limited to women chiefly those between 20 and 50 years of age Clinically it is characterized by an insidious onset by the gradual development of marked weakness lethargy and nervous instability and by digestive discomforts gaseous distension epigastric pain occasionally diarrhoea and anorevia or a fickle appetite. This often leads the patients to avoid meats fruits and green vegetables foods rich in iron and tends to aggra vate the anaemia Marked loss of weight is exceptional

Soreness of the tongue and mouth is common. There is a glossitis and stomatitis which leads to alrophy of the mucous membrane. In at least half the cases there is alrophy of the papillae about the tip and margins of the tongue The process often extends to the dorsum of the longue which becomes smooth and nolished in appearance and to the lips which may show cracks and fasures about the corn is of the mouth In a small group of cases (Plummer 1 insen syndrome a taemia with dysphagia) it extends into the pharynx and hypopharynx causing dysphagia which is attributed to reflex spasm of the interior constrictor

In about half the cases the nails become tender thin and brittle they tend to loosen from the nail bed and may become flattened or even concave and spoon shaped on the

dorsal surface (koulonychia)

Paraesthesias of the extremities are common as in permitious anaemia but combined sclerosis of the cord does not occur

Menorehagia is a common symptom and th anneous may erroneously be attributed simply to the loss of blood Otherwise there is rarely any abnormal tendency to bleed

or any disturbance of coagulation Fertility is but little affected. The spleen is enlarged in about 40% of the cases

The skin becomes inelastic and wrinkled it may be wary white or show slight brownish pigmentation. The sclerae are bluish white. There is never jaundice

The gastric juice shows a hypochlorhydria or an achlorhydria in at least 85% of the cases and a complete achlorhydria after histamine in intrinsic factor, which is present in normal gasting juice (possibly secreted also in the protumal part of the duoderium) and presumably is a ferment although it is not identical with any of the previously, recognized gastine ferments. The effective utilization of this anti-america principle depends also (3) on adequate absorption from the gastionnistinal tract and probably (a) on its storage by the liver and presumably on its orderly release by the liver and distribution to the basemopoietic fusions as it is needed. A disturbance of any one of these functions, whatever the cause tends to produce an anaemia which is macrocytic and hyperchromic in type. A macrocytic anaemia may occur however in diseases which are not assort ated with a disturbance of the anti-permicious anaemia principle (leukae may primary aplastic anaemia efc.)

In pern cross anaemas the disturbance is due to a partial or complete lack of the intimuse factor in the gestro (i.e. a prime and affect conditions deficient absorption is probably the usual cause. In chronic lever discuss empared capacity to store the material may be at facil. In some case as in creata, never a lack of the extrame facts here and the same case as in creata, never a lack of the extrame facts here and extrame the constant of the substance. Any officient demand tegether the claved by supplying adequate quantities of the acts or material preferred as by feed on lever or by macting particularly suitable extract of here keep in the clave of the same and the same capacity of the same capacity and the same capacity and the same capacity and the strength of the same capacity and the strength of the same capacity and
The sett e principle as it a obtained from larer differs in its thermostability and in other properties from that present within the gastronetistual tract, et diding hamp is the 1 and in the stomach assue (ventrochin). Where the slaboration occurs is not known. That the laves ere as a saterochouse for the substance is me certain. It has been demonstrated in the beer of past ents diving of surefused discusses by impecting sixtle levities of oal is herers discuspey materially into states the tip of part close assume as the contract of t

Although the changes in the blood are usually more characters tie and more marked in digree in untreated cases. I permotious anatemia than in the other conditions mentioned in some cases of the latter (e.g. spine did tape orm infact on) they may be and stranguishable. In all these cond to use the bone marrier shows megalol lastic hyperfulsians a warry is degree.

Permissions enaemula is characterized chinically by an insidious onset usually in adults of middle age by the gradual development of a severe anaemia with weakness dyspaoea and other symptoms of haemoglobul deficiency by a protracted course marked by remissions and exacerbations and (in untreasted cases) by a fatal termination.

inadequate ill balanced diet, and the drain on the iron reserves resulting from meastra ation and pregnancy. The defect is permanent more relapie occurs if the administration of iron is storped.

The great significance of chronic occult bleeding has been emphasized recently noble by Heath. It may be that the swidrome is merely a type of chronic positions the emorphagic amacumic complicated by inadequate absorption of iron and perhaps by

other dietary deficiencies.

Clinically this disease resembles permissions anaemia in many ways although the changes in the blood are entirely different. They are similar in that both apparently depend on (different) deficiences of gastires exerction and both occasionally are familial. In several families ultopathic hypochromic anaemia has developed in femiles and pertucious anaemia in males and tarrely both diseases have developed successed; with the same individual. The possibility of a double deficiency must be remembered although only both on examples of this age supmissingly rare.

Chlorous is described as a disease of unknoon etuology limited to females and occurring chiefly during adolescence characterized by the development of an anaemia of the hypochromic type and hy a prompt response to iron medication. The blook charges are defented as with those in adopathic hypochromic ansama: The chief blooks differences are (i) they ounger age incidence in chlorous; which usually subjudes spouts occuping the control of the property of the following state of the property of the property of the United States.

Copper —In animals (lattle rats same) a diet made grossly deficient in coppers as the air ron produces an anismis which does not respond to the administration of uron alone hat which improves promptly deopher is also given. A minute amount of copper is apparently necessary for the utilization of iron. It is very doublish however whether a agmidscant deficiency in copper cours naturally in man even on poor diet.

except possibly in young children

b Anaemias Related to a Deficiency of the Anti-anaemic Factor in Liver

These anaemias are macrocytic and usually hyperchromic in type They include (1) Primary pernicious anaemia (by far the most frequent and important)

Some cases of (2) Sprue ideopathic steatorrhoea and other chrome intestinal disturbances (Fistulae multiple anastomoses chrome obstruction)

(3) Diphyllobothrium latum (fish tapeworm) infection

(4) Cancer of the stomach (rase)

(5) Complete resection of the stomach

(6) Chronic diseases of the liver

(7) Pregnancy (rarely)

(8) Tropical megalocy to anaema
Recent work by Minot Castle and many others has shown that the
normal development and maturation of red cells is dependent on the
activity of a specific substance which is commonly called the anti-nanaemic
principle of liver or ery throcytic maturing factor. The production of two
anti-nanemic principle depends on the interaction of two other substances
(c) Ancatinnsi factor which is furnished by the diet is abundant in muscle
and in yeast rice polishings eggs milk and liver. It is not identical with
any of the recognized fractions of the vitamin B, complex and (2) as

features of a haemolytic anaemia. It is generally believed however that this increased blood destruction is not a primary cause of the anaemia but is the result of the entrance into the circulation of imperfectly formed cells which fall ready victims to the normal physiological processes for the removal of defective cells

According to Minot whose views are widely accepted the fundamental disturbance in pernicious apaemia is madequate cell formation the marrow is hyperplastic the megaloblasts are unable to complete their development and produce crythrocytes There is an arrest of maturation which is relieved by the administration of the active principle of liver

This view has been questioned however, notably by Dobriner and Rhoads (1938) who attempted to measure the rate of red cell formation and destruction in various stages of the disease. They utilized the rate of excretion of urobilin as a measure of red cell destruction and that of

coproporphyrin I as a measure of red cell formation. Although this substance is not directly concerned in the production of haemoglobin they believe that it is a constant by prod uct of the synthesis of copropor phyrin III which is a constituent of haemoglobin and that it can be used to measure the rate of formation of the latter In pernicious anaemia during a relapse they found that cell (haemoglobin) production was actually accelerated as well a cell destruction During a remission the rate of cell destruction fell to pormal and cell formation was also somewhat reduced. They believe therefore that lack of erythrocyte matutine factor results in increased haemolysis rather than in a quantitative reduc-



PG 392-Prn us an m 3fm Megal blast n n m bl st st ppl ng (punctuat batoph (a)

tion in cell output In patients with a red cell count below 35 million adequate liver therapy is followed by a transient reticulocyte crisis which begins on about the third day and reaches a peak on about the 7th or 8th day. The height of the peak varies inversely with that of the initial red cell count

It ha red cell count of o million the reticulory tes should reach 35 to 40" with to about 20" and with 30 about 5" I less r rise indicates either a mistaken I agno is in dequate do age or s me complicating dies. If the init al dose of acti e principle has been too small as indicated by an a adequate r ticulocyte response an i cre se in the d e will be f llowed by a sec ni reticulocyte cris s However if th 1 to I dose was adequ to a further merea e will ha e no s graft ant effect on the ret cul series. These obser ations ha e pro ed to be of great pract cal value in the control of treatme ! In favor ble e ses the red cell count may rise 20 million in ne m nth normal figures will be attained after 2 to 3 month and the qualitative abn smalt es entirely disappear except f r the persistence of a few macrocytes. The Foresthesius of the extremitten nearly always descipe and are often an early sympon for Total degenerations of the conf (combined sciencis) are common. They occur (i) in the posterior columns causing afarse weakness and minor sensory disturbance particularly loss of the absolvers sens over the lower legs diminished referes occusion ally hyperaesthesias (s) in the lateral columns causing spatitically exagented referes and less often sphincier disturbances. These changes are not proportional to the anaerma and may anistediate at Rarely combined sciencis occurs in spitiants who anistediate at those of the science of

In practically all cases there is an achierhydria even after histamic injection. The volume secreted is scarty and is increased but fittle by histamine. Mucus is scarty. The ordinary ferments are usually diminished, and often absent (true achylia). The gastric deficiency permanent even in well treated patients. A few are cases have be reported who showed free HCl in the gastric juice. The intrinsic factor has been absent in those cases of this group which have been tested as to this point. There is some evidence to indicate that the lack of intrinsic factor in pernicious anaemia in some cases at least is relative rather than absolute. It has been suggested without as yet definite proof that variations in the amount of intrinsic factor secreted may account for the fluctuations in the course of the disease.

The blood shows a marked reduction in the red cell count frequently to 2 or rarely to 2 or million or less. The haemoglobin is relatively less reduced so that the color index and mean haemoglobin content of the cells is increased. The volume index and mean corpuscular volume are also increased omore regularly and often more markedly than is the color index. The haemoglobin concentration is the cells is normal or slightly reduced. Anisocytosis is marked and in severe cases it becomes more pronounced than in any other anaemia. Poskilocy tes microcytes and macrocytes are numerous. Large oval deeply staming cells are highly characteristic and a few are usually present in the early stages of the disease and during the remissions. The mean diameter is increased (to 8 5 to ga) and the cells are dark (the thickness is also increased).

A few normoblasts are present in most of the cases with marked anaema Typical megaloblasts are present at some stage of the disease in untreated patients but they may be hard to find They can rarely be found after treatment with liver even though this is inadequate in quantity During the blood crises which occasionally occur in untreated patients there is a sudden outpouring of normoblasts and megaloblast retruloty exp polychromatophulic cells and cells with nuclear particles

The platelets are reduced There is a leukopenia A few my elocytes are often present but on the other hand there is a shift to the right in the sense of Arneth with occasional huge neutrophiles containing hyper segmented nuclei with 6 to 10 lobes permicious anaemia neutrophiles.

During the exacerbations of the disease there is mild jaundice an increase in the bilirubin in the serum and all the other characteristic

deficient protein diet. Nutritional anaemia is frequently associated with malaria and ayphilis and with severe infection in ancylostomiasis. Fair ley Bromfield and Conde have reported a macrocytic baemolytic type which is prevalent in Maccionia and is accompanied by splenomegaly due to chronic malaria infection. In this type there is a primary nutri tonal deficiency with a haemolytic agent the malaria parasite superadded.

Tropical megatocytic sasemis is a dwaws described as occurring in the nati is population of west Africa India and Chain (While and Melber 1996). How course shiefly in women between so and 30 and is often preceptated by pregnancy. The symptoms are those of any severe antenna. Godenas is often marked. There may be a glossification of the statement of the severe and
The annemia also responds quickly to treatment with liver or liver extracts although probably not to Anahaemin

Differential Diagnosis.—The disease was originally confused with perficious anaemin and it is indeed difficult to differentiate the two conditions by a simple blood examination, it has however a different age incidence.

In permicious annemia there is achiorly dria and a positive indirect van den Bergli reaction whist in tropical nutritional annemia the opposite is found. Glossitis is much more common in permicious anaemia. Difficulty, in diagnosis arises muntly, no other tropical conditions such as sprue and indeed more than one macmia producing disease is often found in one and the stime subject.

one and the sime super.

Tropleal macrocytic ansemus, or the macrocytic anaemia of pregnancy has for a long time been recognized in India Malaya West Africa and other tropred countries. Will Selected it could be differentiated from the perincious amenia of pregnancy which occurs in temperate climates. This anaemia of pregnancy is especially due to dietetic deficiencies aggravated by sujeradded infections of malaria and ancylostomians. Del angen points out that what special diet leads to its production is not yet known. It appears however that the chortage of vitamins A and C pits a print in the production is especially when at the same time the diet contains large quantities of fits. In women with a relative vitamin A and C shortage four with sufficient vitamin B is olong as they take but the small est possible quantity of fat the disease practically is never seen. There appears to be no essential difference between this form of macrocytic anaemia described alove and studied by Wills and Melyta and others.

Sprue is a tropical or subtropical disease of unknown chology occurring most frequently in In It China and the East Indies where it is ant to attack white immigrants from temperature latitudes. It also occurs in the reappearance of these abnormalities or a fall in the red cell count indicates that the maintenance dose of liver is inadequate. Dried defatted stomach (b) mouth) is as effective as liver so administered.

Failure to secure a satisfactory response mofres due to deferent absorption from the gastronizational tract. In such cases scredient results can be obtained by informacial impedious which on the average are at least 50 times as effe tive as the administration of equivalent dones by mouth. With the best preventations a manumum response follows can usually be maintained by a similar done given once a neck and in some cass rock and usually be maintained by a similar done given once a neck and in some cass rock and mouth. To control this process it may be necessary to ging 2 or given the amounts. To control this process it may be necessary to ging 2 or given the amounts of the control this process it may be necessary to ging 2 or given the amounts of the control this process it may be necessary to ging 2 or given the amounts.

Although the pathogeness of permatous anaema as now fairly clear the underlying cause of the defective gastre secretion remains obscure. In some cases it is a familial constitutional defect. Many families have been reported in which two or more men sens have been permatous anaema or in which other members have had now had so that the permatous anaema or in which other members have had now had been a support of the permatous anaema are athems in type and have a light complexion with of the other members have had not had been a support of the design of the d

The theory that a chronic dictory deficiency plays a part is attractive and retries one support from the experiments of billier and Rhoads (rops). By feeding some suitably deficient diet they produced a diseased state closely resembling tropical spiral (less closely) permittons anaemia in man. These animals aboved an anaemia (usually macrocytic) with gastromiestical disturbances and stomatists the infinite factor disappeared from the gastromiestical disturbances and stomatists the infinite rated risks and the bone marrow showed megaloblastic hyperplasia. The condition responded to misections of liver extract

Pernicious anaemia appears to be very unevenly distributed in different parts of the world according to the published reports DeLangen and Lichtenstein (1936), in their studies upon the anaemias of the tropics state that during 20 years we have never seen a case of pernicious anae mia in a native patient in Java although in our Department for Internal Diseases in the Central Hospital in Batavia with its 300 beds a very intensive search for this blood disease has been made. Nor have we ever seen a case amongst the poor Chinese patients in Batavia but on the other hand amongst the Europeans and the better situated Chinese in the tropics it is met with occasionally In Africa no pernicious anaemia is found amongst the negro races it is only found in certain of the tribes in the neighborhood of Lake Tanganyika whose food consists for the most part of meat and dairy products. This is of great interest for a study of the cause of permicious anaemia. The countless cases of achylia gastrica found in the tropics appear not to contribute to the appearance of this serious disease if uncomplicated '

In Ceylon the death rate is given as amounting to 3 per hundred thousand of the population but in Japan even less o 6 whereas in the north right of the state of and in England as 8 per hundred thousand The difficulties of making a correct diagnosis in natives especially when infected severely with an intestinal parasite, is suphestized.

Nutritional macrocytic anaemia is more or less universal in those tropical countries where the population subsists on an unbalanced and

which are of theoretical interest but little practical importance a macrocytic hyperchromic anaemia develops which may be indistinguishable from perincious anaemia. This may temporarily improve under liver and is attributed to loss of the intrinsic factor. The anaemia which follows extensive operations on the stomach also is more often hypochromic than hyperchromic in type.

Myzordema frequently causes an anzenna which may be either hypochronic or hypochronic art hyp. The latter type of anaema is releved by heer and is satisfulated to a fick of infininse factor which may be temporary (ref eved by administration of thyroid alone) or permatten (requiring continuous administration of liver which controls the anaema but not the myzordema)

Pregnancy is so frequently associated with a midd hypochromic type of anerma that some have regarded this as physiological. This usually increases gradually from the third to the seventh month after which there may be some spontaneous improvement. The red cell count not infrequently falls to 35 and the IIB to 50 to 60%. Occasionally much lower figures are observed. The anaema responds well to iron and is due to aniron deficiency. The latter is probably due in part at least to poor absorption associated with the hypochlorhydra or achlorhydra which is commonly observed during pregnancy. It is partly, the result of an increased need for iron to supply the foetal tissues. The apparent degree of the anaema is somewhat exaggerated by the hydrama which is present. The anaema usually subsides after delivery. Failure to do so suggests the presence of shopathic hypochromic nanema which is markedly aggravated by pregnancy. There is apt to be a recurrence in subsequent pregnances.

In relatively rare instances a hyperchromic macrocvite anaema dec elops. The changes in the blood resemble closely those in permicious anaema. There are evidences of increased blood destruction. The disease is severe runs a relatively actue course without remissions and is often fatal if untreated. It may appear during the purepertum but spontaneous recovery may occur after delivery. It responds well to invertiferequently also to transfusions) and recovery is usually permanent. It may not recur during subsequent pregnances. There is usually free HCI in the gastre juice but subaculdy is common. Lack of the intrinsic factor—presumably temporary—has been reported in a number of cases Strauss reported two cases who developed periations anaema later.

c Anaemias Related to a Functional Insufficiency of the Bone Marrow (the Aplastic or Aregeneratory Anaemias)

The madequacy is usually relative but in rate instances there appears to be a virtual cessation of red celf formation. The matrix as a rule is a plastic to a greater or lesser degree. In some cases however it shows market hyperplass and there appears to be an arrest in the maturation of the cells. Among the more important conditions in which anaemia of this type occasionally occasionally occurs are the following.

West Indies and has been observed in the southern United States. It occurs chefit, in adults more frequently in women. It is characterized by the gradual development of a chronic morning diarrhoea with progressive emaciation weakness and anaemia. The shoots are typically bulky grevish pultaceous and frothy, and contain large amounts of fat chiefly as fatty acids. Glossitis and marked atrophy of the mucous membrane of the tongue and the entire gastrointestinal tract occur associated with great fixtulent distension. Tree HCI is present in the gastro-juce in most cases and (if absent) may return during a remission. The intim sic factor of Castle has been present in some cases and absent in other. There are no bone changes and no gross disturbance of calcium metabolism.

Anatum is present in most cases but varies much in severity (red cell count usually about 3 o but may fall below 1 o). It is usually macrocytic and mildly hyperchromic in type resembling permicious anaemaexcept that the abnormalities are less marked. The anaema often
responds to veast and regularly to liver. It is probably due mainly to
defective absorption of the anti anaemic principle or in some cases
to lack of the intrinsic factor. In a minority of the cases the anaemia is
hypochromic and these cases respond to iron but not liver (see also
Chan \times\times\times).

Idopathic steatorrhose (coclus disease non tropical sprue) is a di case of temperate inmates which usually begins in infranço or billiohood although it may not be recognized until adult life. It is characterized (1) by chronic diarrhose with abdominal distension and fatty but not frothly stoods (2) by a distribution of metabolism associated with defective absorption of calcium saits and vitamin D and characterized by osteopeous pains in the bones bone defermenties and patholo, cal fractures and (3) by exacution and anaemia which are often evere—tellophydra is rare—Clositis may occur and one degree of strophy of the lingual spatilise is not unconsort some degree of strophy of the lingual spatilise is not unconsort. The companies of the body of the consorting the

The anaemta is usually hypothromic in type particularly in children. The color index is low and anisosy loss is marked. The average cell diameter is usually within normal limits, but in some cases it is distinctly increased. Rately numerous notion blasts have been present. The anaemia (but not the other 3 mptoms) is relieved by iron and it is attributed to defective absorption of iron.

In other cases particularly in adults the anaemia is macrocytic and mildly hyper chromic resembling that commonly seen in sparee. In this type the anaemia responds to the administration of liver or large do es of yeast preparations and a attributed to

defective absorption of the anti-anaemic principle

Diphyllobothrium latum infection causes anaema in only a very smill proportion of the infected individuals. In these cases it may be severe and practically individuals in the same as except that combined selerous rarely if ever occurs. The anaema is usually cured permanently simply by expulsion of the worm. It is also cured by liver but his must be continued until the worm is regolded. Tree IRC1 usually absent but may return after expulsion of the worm. Hernberg (1936) reported finding the intrinsic factor.

Cancer of the stomach often causes anaemia which is almost invariably hypochromic and microcytic in type. In the absence of bleeding it is usually moderate in degree but may be extreme $(B \cap B \cap B \cap B \cap B)$ and quite like that in idiopathic hypochromic anaemia. In rare instances

which are of theoretical interest but little practical importance a macrocytic hyperchromic anaemia develops which may be indistinguishable from perincious anaemia. This may temporarily improve under hierand is attributed to loss of the intrinsic factor. The anaemia which follows extensive operations on the stomach also is more often hypochromic than hyperchromic in type.

Myzodené frequertly causes an anaemas which may be either hypochramic or hyperchromic in type. The latter type of sanema is releved by he and is attendated to a lack of ritinase factor which may be temporary freshwich by a finansitration of thyroid alon) or perman at (requiring continuous administration of hiver which controls the anaema but not the myzodefan).

Pregnancy is so frequently associated with a mild hypochromic type of anaemia that some have regarded this as physiological. This usually increases gradually from the third to the seventh month after which there may he some spontaneous improvement. The red cell count not infre quently falls to 3 5 and the Hb to 50 to 60% Occasionally much lower figures are observed. The anaemia responds well to iron and is due to an iron deficiency. The latter is probably due in part at least to poor absorption associated with the hypochlorhydria or achlorhydria which is commonly observed during pregnancy. It is partly the result of an increased need for iron to supply the foetal tissues. The apparent degree of the anaemia is somewhat evaggerated by the hydraemia which is present. The anaemia usually subsides after delivery Failure to do so suggests the presence of phopathic hypochromic anaemia which is markedly aggravated by pregnancy. There is apt to be a recurrence in subsequent pregnancies

In relatively rate instances a hyperchromic macrosytic anaemia develops. The changes in the blood resemble closely, those in permicious anaemia. There are evidences of increased blood destruction. The disease is severe runs a relatively acute course without remissions and is often fatal of untreated. It may appear during the pour-perium but spontaneous recovery may occur after delivery. It responds well to hive (frequent) also to transfessions), and recovery is usually permanent te may not recur during subsequent pregnanties. There is usually free filled in the present of the intrinsic factor—presumably temporary—has been reported in a number of cases. Strauss reported two cases who developed permicous anaemia have

c Anaemias Related to a Functional Insufficiency of the Bon- Marrow (the Aplastic or Aregeneratory Anaemias)

The madequay is usually relative but in rise instances there appears to be a virtual exestion of red cell formation. The marrow as a rule is aplastic to a greater or lesser degree. In some cases however it shows marked hyperplasts and their appears to be an arrest in the maturation of the cells. I mong the more supportant conditions in which anaemia of this type occasionally occurs are the following.

- In new born infants as a rare constitutional defect
- 2 As a terminal phenomenon in anaemias of other types as in chronic posthaemorrhagic anaemia, pernicious anaemia and the myelopathisic anaemias
- 3 Anaemias secondary to infection particularly to such chronic infections as subacute hacterial endocarditis chronic infectious arthritis chronic pyogenic infections and oral sensis
 - 4 In advanced chrome nephritis (usually normochromic in type)
- 5 Malignant disease in most of those cases in which haemorrhale does not play a part
- 6 Dietary insufficiencies other than simple lack of iron, including the avitaminoses such as scurvy, etc.
- 7 Chronic poisoning with such chemicals as benzol, innitrotoluol arsenic gold or radium salts (Martland, 1031)
 - 8 After excessive exposure to \ rays or radium
 - 9 Acute idiopathic aplastic anaemia
 - 10 The myelophthisic anaemias

This list manifestly includes many heterogeneous unrelated conditions and the changes in the blood which they show vary in detail A high grade of annemia may occur in all of them. In the milder cases some new cell formation persists and the blood shows imperfectly formed cells and immature red cells in small numbers The blood often resembles that in cases of posthaemorrhagic anaemia except that the hypochromia and microcytosis are usually less marked. In severe advanced cases the appearance of the blood is more distinctive Despite a marked degree of anaemia, the individual red cells which remain are relatively normal Amsocytosis is slight and the color index and volume index are usually within normal limits. The anaemia is normocytic and normo Reticulocytes and other immature red cells are entirely absent There is a neutrophilic leukopenia and a reduction in platelets which may be extreme, and associated with a (symptomatic) purpura haemorrhagica There is no evidence of increased blood destruction

In Idiopathic aplastic anaemia these features are seen in maximum degree. This is a rare disease of unknown cause occurring chiefly in adolescents and young adu ts characterized by progressive weakness and prostration fever rapidly developing anaerus extreme leukopenis thrombocytopenia purpura and bleeding and a fatal o atcome within a few weeks or months. It is the aleuka of German writers. The spleen is not enlarged. The gastric junce is normal. The bone marrow in typical cases. is markedly aplastic Cases which are chinically indistinguishable however have shown marrow which is normally cellular or even hyperplastic and in some of them reticulo cytes normoblasts myelicytes and myeloblasts have appeared in the circulating blood Krumbhaar has suggested the term pseudoaplastic agaemia or progressive hypocythae mia for such cases The disease has been confused with permicious anaemia and (more poisoning with benzol radium etc may present an identical picture

Scurvy may cause a severe anaemia (R B C 20 Hb 30%) which is hypochromic and usually microcytic in type It can not be explained by the (relatively trivial) haemorrhages which occur It is not influenced by iron or liver but responds to

vitamin C with a reticulocyte crisis and rapid improvement

Myelophthuse anterms is a term applied to those condutions in which the cri hirpoportic tissue of the marrow is maded and more or less crowded out by other tissue. Except in extensive leukacimic inflitration the bulk of the invading tissue is rarely sufficient quantitatively to explain the anaemia on the basis of simple mechanical displacement and a functional inadequacy of the remaining marrow must be assumed. These include

- I Osteosclerotic anaemia
- 2 The leukaemias
- 3 Some cases of Gaucher's disease and allied conditions 4 Metastatic tumors in the bone marrow (frequently)
- 5 Multiple myelomata (occasionally)
- 6 Hodgkin's disease (rarely disputed)

In many caves the anaema is slight or moderate in degree but it may be severe. Amisor tosis is often marked but the color index and volume index are usually about normal or moderately reduced. In many (but not all) cases the blood shows changes suggesting, intense stimulation (or initiation) of the marrow. There are numerous immatuse erythrocytis including many normoblasts and macroblasts and even megaloblasts. There is a neutrophilic leukocytosis with melocytes in varying number and occasionally a few myeloblasts. They are sometimes classed as erythroblastic anaemies. (Vaughn). Areas of hyperplastic erythropocite tissue are commonly found in the long bones or sometimes in the spleen and other ettimedullar; tusues.

Ottocolerobe assemus is a term usually applied to the condition described by Albers Schönker; as malle bone disease. This is a six disease to dishown studiesy which may be dependent on a constitutional abnormality of bone development and it sometim is familial. It begins in early he elibooph it may not be recognized until the thard decide. It is characters ed by a peculiar type of irregular the change of the bones involving especi by the balls of the long bones. The new bone encreaches on early environmentally many largely obligates the merrow which shows in addition extremize fibroris in system of the thickening the bones are far le and ogn o deformines and pathological institutes are common. In the later singree is every enarem a de clops (as low in R. B. C. 95 Ell 100° Caught) characters of by e marked explicitled in The splees and

h er are much enlarged as a result of myeloid hyperplassa.

Myelosderos a is a letin epphed by Mozer (1927) to a somewhat similar cond tion
developing in adults in which life bones become ebnormally den e but not widened
a d the c liular marrow is replaced by bone and fibrous tissue. Eventually a severe

anaemia develops with erythroblasious and splenomer ly

C Anaemias Associated with Afgelebated Blood Destruction (Haemolytic Anaemias)

Although accelerated blood destruction is a prominent feature of these diseases in many of them madequate blood formation is also important in the production of the anaema. In some of them as in peri cious anaema socile cell anaemia and probably haemoly ite jaundice the pri mary disturbance appears to be the formation of red cells which are inherently defective and thus susceptible to the normal processes for removal of damaged cells. There is no positive evidence that anaema is

produced by removal and destruction of normal cells because of a perm cious overactivity of the reticuloendothelial tissues

In nearly all cases red cells which are defective or which have been damaged are removed from the circulation before baemolysis occurs. If the rate of red cell destruc tion is accelerated (or if the liver is injured) the liver may fail to remove the bilirubia from the serum as fast as it is formed As a result bilirubin accumulates in the plasms and gives the latter a yellow color. The acterus index rises and the serum gives a positive (indirect) van den Bergh reaction. The skin and sclerae become more or less jaundiced. In some cases this may be deep but usually it is relatively slight and the color is a pale lemon yellow rather than the orange tint of obstructive jaundice. The difference however is purely a quantitative one. The color in both cases is due to bilirubin. The urine becomes dark colored, and contains increased amounts of urobilin and probibnogen but no bibrubin (or only traces). The sediment may show renal epithelial cells containing haemosiderin granules The urobilin in the facces is increased At autopsy the amount of iron in the liver and spicen is increased These phenomena are marked only during periods of rapid blood destruction. If the latter is relatively slow they will be slight and perhaps limited to a small increase in the bilirubin in the serum

The rapid destruction of red blood cells in the body regardless of the disease in which it occurs gives rise to a characteristic clinical syndrome There is fever, sometimes a chill weakness and prostration, pain in the back and crises of acute colicks abdominal pain with pausea somiting and jaundice. It may simulate various acute abdominal conditions and has led to unnecessary operations

In rare instances in which a large number of red cells are rapidly destroyed the cells may be haemoly zed in the circulation and the haemo globin liberated into the plasma (haemoglobinaemia) If the amount of haemoglobin so liberated is large (when about 160 or more of the red cells are abruptly destroyed) haemoglobinuria occurs

This is met with (1) After transfusions of incompatible blood (2) In paroxysmal haemoglobinuris (3) In black water fever (4) Rarely in severe infections and intoxications of the types enumerated below (as in gas bacillus gangrene and poisoning with arsemuretted hydrogen) and in favism (5) In march haemoglobinuria (6) In paroxysmal nocturnal harmoglobinuma

A haemolytic anaemia usually authout hiemoglobinaemia and haemoglobinama is

met with chiefly in the following conditions

s Some acute infections as gas bacillus gangrene sepsis especially puerperal sensis and other streptococcal infections typhoid fever malaria and Oroya fever Rarely a profound anaemia may develop within a few hours

2 Some cases of acute por oning with certain drugs phenol benzol and their denva tives mitrobenzene transtrotoluene ambne phenylhydrasine acetanilid and the sulphonamide drugs saponin potassium chlorate lead and other heavy metals arseniaretted hydrogen snake venom etc

3 Rarely in leukaemia Hodgkin s disease carcinomatosis 4 Extensive burns

5 Idiopathic cases including the acute febrile haemoly tic anaemia of Lederer

7 Permetous anaemia and related macrocy tic anaemias during acute exacerbations of the disease

8 Famihal haemoly tic jaundice

o Sickle cell anaemia 10 Icterus graves neonatorum

Cooley's erythroblastic ansemia

The morphological changes in the red cells in anaemias of this type are not distinctive except in the specific diseases pernicious anaemia haemolytic saundice and sickle cell anaemia. In severe crises spherocytes may be found Amsocytosis and amsochromia are usually moderate and are typically less than in chronic posthaemorrhagic anaemia of the same degree The volume index (mean corpuscular volume) and color index may be somewhat reduced but more often they are within normal limits and occasionally they are increased. These anaemias are not hypochromic probably because the mon from the cells which have been destroyed is retained in the body and is readily available for the production of new haemoglobin Evidences of active red cell formation reticulocytes polychromatophilic or stippled red cells even normoblasts are usually present and may be numerous as in lead poisoning. In acute cases there is usually a leukocytosis and an increase in platelets. In protracted chronic cases the blood may finally assume the features of an aplastic type of anaemia

Paroxymal haemoglohuntra is characterized chierally by recurn is bind paroxyming of chills lever ju in in the back per stration cranes wounting or durinos a numbers in the extrem ties is disacronglohuntra. The individual attacks are usually precip, tatted by expour to cold or experimentally by bolding the arm in recise sate. They are follo ed by j undic and (themoglytic) and expan which may be severe (R BC to). The haemoglytis ybrough it should by an hair analyming of the usual complex type. The

The haemolysis s brou ht about by an ha molysis of the usual complex type. The stable constitut at (amboceptor 1 specul in 1h 11 t vill combine with cells only at a low tempe ature. Once combined it renders the cells susceptible to the lytic action of complement who warm d to body temperate e (the Donath I andsteiner phe omittens)

No.	Serum o 5 c	Cell su pen ston 2 cc	C mplement	Salt sol c	Positive result
,	P tents Co trol	Patsent s Control	0 2	0 1	Haemoly sis
3	P tient s	Control		۰	Haemoly 318
4	Cont ol	Patient s	0.1	0.1	•
6		Patient s Control	0 2	0.6	0

The her is n can usually be dem notted in the following simple manner. Part about cot offresh (n m) blood meach of who test those and keep at by disrepertative until the serum has separated. Acep one tube in the water bath at 3 σ C as a control adopt the off n incree sater for 10 σ m units. Then part his sun her is bath for an har if the serum is the control is become of the serum of the control is become an exception of the harmony is indicated by more or le is pinging file earns in the action thus the harmony is not cated by more or le is pinging if the earns in the action thus the result is distributed at it each tube a title addit and complement a direct ato the water bath which and it is not the service of
in a warm syr ge allow ah ut Sec 1 clot (f serum) and oxalate the rest. The blood solutions and appar tus must be kept at body temperature the got all man pula tons. Wash the it and pepare a 5 cr suspens n Serure 10 cc of normal human.

blood of the same blood group and treat in the same way Prepare a r to so dilution of fresh guinea pig serum as complement Set up tubes as shown on page 36r

Put all tubes in ice water for 10 minutes and then in the water bath at 37 C for half an hour. A positive reaction is indicated by hiemolysis in tubes (r) and (g) and

by absence of haemolysis in all the other tubes

The condition is regarded as a rare late manifestation of syphilis since a large proportion of patients give a positive Wassermann reaction and it can sometime be used by adequate treatment of the syphilis. The haemolysis has been observed in some cases of late syphilis who show no clinical symptoms of paroxysmal haemoglobinum but not in other conditions.

as long marches or standing for hours in a lordotic posture

Parozysmal paralytic 'haemoginbanura (sumiar to a relativel) common dusase of horise) has been reported in a few buman cases. There are recurning attacks of externer muscular weakness followed by haemoglobmuta and later by more or less marked muscular atrophy but hittle or no anaemia. The pigment exercised is myejebbar The muscles in fatal cases show marked degenerative changes and loss of pigment (in flesh). A somewhat sigmilar acute degeneration of stringted muscle with myejebbarura has been observed in kongigberg (Haffitzahler) in individuals fund in cati) who had eaten fish which had ingested poisonous resinous acids the waste products of cellulator lateroids.

Paraysmal nocturnal haemoglobunta is a chronic relapsing disease of unknown toology characterized by an insidious onest with weakness anactima justiced and later recurring attacks of hiemoglobinuma without obvious exciting cause which bouilty occur at night and lead to severe anacems. The blood shows a continuous haemoglobinaemia, a leukopenis many retirufocytes and normal fraphty. Ham (1970) reported that the increased haemofysis occurred during sleep and was associated with a fall in the pII of the plasma. The abnormality seemed to be not in the plasma but in the cells since they are haemofysed an actified fresh serum either of the platent or dorintal individuals of the same blood group. Splencetomy has not been benefind, (Reviewed by Witts (1955) and by Hamburger and Bernstein roll and benefin.

In none of these conditions is there any relation to syphili or to exposure to cold and

the Donath Landsteiner phenomenon is absent

Lederer a acute haemolytic anaemia in a syndrome nheeved chiefly in children and young adults and characterized chincilly by an acute mast with fever by the rapid development of a sevele haemolytic anaemia (R B C to 10) with great prostration jaundice abdominal plain vomiting distribers after purpura and haemorthies sonsilly assign and urenum. There is usually a leucocytosis and often many myelecytes and some myeloblasts appears in the blood. Riseoftes failed not propelly the blood in usually be cured by propult and repracted translations or if these fail by sphere tomy. It can not be distinguished sharply from other claims types of haemolytic anaemia of unknown cause and is probably but a disease entity.

Lead poisoning frequently causes an anaemia which is usually hypochromic and moderate in degree (R B C 3 to 64 c) but may become sever in severe cases it may cause an acute baemolytic anaemia. DeLangen has reported its prevalence in natives in the Dutch East Indies both from accidental ingestion of lead and from the very extensive use of face powders with high lead content. Young children thus become poisoned from their mothers. The most characteristic feature of the blood is the appearance of many retrudoy tes and stippled cells. These cells may appear within a few days after exposure to lead in the absence of appreciable anaemia Although stippled cells may appear in any anaemia in which active red cell regeneration is taking place and although they may be sparse in some cases of lead poisoning their early appearance and their presence in large numbers is highly characteristic

Actual counts of 1 ppled cells have been utilized to detect a d measure the degree of absorption of lead in industrial workers In Germany a count of from 100 to 300 per million red cells has been regarded as an indication for enforced change of occupation Belknap (1935) has found that men with counts of 500 to 1000 per million might continue at work for years without clinical symptoms of lead poisoning but that an abrupt increase above these figures was usually followed by acute symptoms Counts of 40 000 per million and more ha e been observed. The number may be estimated by counting the number of stoppled cells in 50 oil immersion fields in an ords nary thin film and multiplying this figure by oo (the average number of red cells per field is about 200 and this should be rou bly checked by those not experienced in such McCord's h sorbibe aggregation test in which dried thick films without fixation are stained with Manson s methyle e blue should be used if the cells are sparse An increase in reficulocytes although less specific is an earlier and more sensitive sign

of lead absorption than the appearance f stippled cells. There is a rough parallelism between the counts of the two types of cells Jones (1935) found the number of reticulocytes trebled with oo stippl d cells per million and a times the n rmal with 1000 stippled cells per million Reticulocyte counts [6er and m re have been observed in acute po soming Jones fou dappreciable numbers f normoblasts in about 500 of the chronic CRSCS

The resistance of the red cells to hypotonic salt solution is creased but the cells appear to be abnormally frag le and susceptible to meeban calinjury (Aub)

Acetanikd and r lated drugs in over dose cause a transformation of baem globin to metha m glob This imparts to the mucous membranes a character istic dusky ey not e t ge It can be recognized by spectroscopic e ami nation but must be differentiated care fully from a lpbacmoglobin which go es

Fig. 191 - Sickle cell in mia how g nu usu I numbe of a t ned film Th n rmoblasts Upp Ift Macrophage at a gared pu 1

a closely similar spectrum As a rule after removal of the po son there is a revers on to normal baemoglobin without much mjury to the red cells. More rarely it causes a severe acute baemolytic anaemia associated with a leukocytosis and occasionally an erythroblastosis.

Sickle cell anaemia is an hereditary constitutional anomaly practically limited to negroes transmitted by either sex as a dominant Mendelian characteristic and characterized by the tendency of the red cells (in sealed fresh preparations) to assume characteristic bizarre shapes. The cytoplasm of the cells at two or more points becomes drawn out into elongated spine like projections so that the cells become crescentic or more often oat shaped or uregularly stellate Hahn and Gillespie found that the cells would resume the normal shape if oxygen was supplied to the preparation and would again sickle if it was withdrawn. These distortions are not seen in ordinary fixed films, except to a slight extent in a few cells in the severest cases

A majority of the individuals who show this trait are symptomiles. In a few case recurning attacks of acute haemolytic anaemia occur with partial recovery in the intervals. In addition to the usual symptoms due to acute haemolysis older patients often complain of deep seated pains in the bones and joints often associated with ostoporous in zorintgenograms and chronic punched out utieces sever the lover legs. The skill may show changes aimilar to those in Cooley's anaemia, young children later it becomes small and fibrouts symptoms appear in childhood (if at all) and if severe the prognosis is unfavorable. Retardation of development both mental and physical is common

The degree of anaemia is variable but it may be profound (R B C 1 or less). The color index and volume index vary but usually are about 1 o. There are many returnly cytes and polly chromatophilic cells and often many normobiasts. The fragility of the ted cells is normal. There is usually a leukocytosis and an increase in platielts. In severe cases monocytes containing phaseovier der cells can often be found.

Elliptical red cells which occur as a rare familial trait in Caucasians must be sharply differentiated. The cells do not sickle and the condition does not cause anaema or impair the health.

Haemolytic Jaundice—Two types have been described (i) a con grantal familial form and () an acquired form, occurring later in life and without a familial history

Familial haemolytic jaundice depends upon a constitutional anomaly which is transmitted by either sex as a dominant Mendelain characteristic. The disease usually becomes manifest during the second or third decade and is characterized by recurring attacks (crises) of haemolytic anaemia, with the usual symptoms of acute haemolysis and outspoken jaundice. The serum bilirubin may be increased to from 10 to 50 times the normal in the intervals there is partial recovery but some anaemia and jaundice persist. The acute attacks may be precipitated by an acute infection or other associated disease but often no exciting factor can be found. Gall stones develop in about half the cases and gall stone cole and obstructive jaundice may mask the underlying disease. The spleen is regularly enlarged. The bone marrow shows a marked hyperplasia which is usually infriendiblatic. The bones may show thickening and reafection in rocat genograms. Extra medullary areas of hyperplasia may occur. The disease causes marked disability, but is rarely directly fatal

The degree of anaemia is usually slight or moderate, but may be marked. The average red cell counts from 3 o to 3 5. The color index and volume index (and mean corpuscular volume) are normal or slightly increased. The distinctive features are: (i) The diameter of the red cells a dimmisshed but the mean volume is not significantly altered hence the thickness must be increased so that the cells are more globular than normal. Naegel (1970) termed them spherocytes and regarded their formation as a manifestation of the constitutional anomaly underlying the disease. Krumbhaar has called the disease spherocyte reterus (a) The resistance to hypotonic salt solution is dimmisshed. Harmolysis usually begins in concentrations from 0.5% to 0.6% rarely even 0.8% (instead of 0.44%) and may be complete at 0.4% to 0.43% (instead

of 0.34%) Not infrequently however the divergence from normal is relatively slight (3) Reticulocytes are much increased often to 16% or 50% rarely to 50% and more. Other evidences of regeneration are present including frequently a few normoblasts

Splenetomy stops the rapid cell destruction and usually effects a permanent clinical cure although the abnormal shape and dim numbed resistence of the cells persist in some degree. Relapses have occurred and in some cases have been associated v th hyper plants of accessory apleans.

Not infrequently examination of the relatives of a pat intire calls latent cases with a slightly of minished resistance of the red cells to hyp tooic salt solution as the only manifestation of the anomaly

Acquired haemodytic pandede as usually defined differs fundamentally from the familial type only in the late nonte and apparent take f. Hengdatry factors. The condition is usually attributed to some a fection or other organs educates (which is not always demonstrable). Cincially the disease is educated as usually more severe than the familial type: the anaema more protound (R B C average a musuum o 3) and a fatal utcome common. Spleectomy as less requisity effect a The globular shape and dimmahed resistance of the red cell are often less clear cut. Is these features constitute the only dee use characteristic by which the condition can be different acts for m ord sary acute heemolytic anaemas man) have questioned its existence as a datted disease entity.

Damichek (Medicine 1949) has reported producing in naturally by specitions of hemolytic serum an anamian shock of a ly seventhele acquar of hemolytic serum an anamian shock of a ly seventhele acquar of hemolytic psounder in man including the presence of spherocy tons and increased feaplity of the red cells. He haspointed on the frequent necessary class as not increased feaplity of the red cells in man of both known and unknown a retology and bed even no distinction can be drawn heaven excet hearmolytic santen as and acquared hearmolytic santen exploritions of spherocytosis and seventheless of the second service of the second
Congenial Explanoisation Asserman (Explan blastous Dotalia) —This is a one gential faminal that each offer the process of whintown totalogy. It appears in three dats n t of n cal types hich probably represent if firent stages or different types of cases we children in the set family are offeren effected and may show different types of cases or different stages of the set of the se

of Hyd ope Focialis —In this type the infant is still born or dies with n a few bours. There is marked generalized oedema of the placenta and filetal rissu is cardiac dilatation divisione and communication.

b Intern Con Vendorum—There is juind or which may be present at birth or may app ar during the first or to 45 hours. It increases rapidly to a deep orange howan color. Petchase may occur. The desared until ated a fatal within the first week in about 80° at the cases but it case often be cared by sep ated small transfessions (Hamps no 60° 1) the cases but it case often be cared by rep ated small transfessions (Hamps no for 1) the transfessions.

to current a trape of interamogeness supercions of normal human serum. Recovery of the occurs its multi-earning manners. The issues are deeply interior include again some cases the basal gangla of the octerus of and there are extensive deposits of stofaron pigment of Congress toll smooths. The new form a practically adont call with the preceding type except for a molifier own and for the absence of passedies. It is distinguishable from the

simple hypoch omic anaemias chiefly by the erythroblasto a and splenomegaly

The erythroblastic ansemla of Cooley as congenital and often familial constitutional anomaly largely limited to children of eastern Mediterranean races. It is characterised by (1) a hypochromic type of anienna which becomes severe (R B C 1 7 Hb or?) (2) mild juundice with hyperbolirubinaenna (j) a leukocytosis. (4) a marked epitholiatosis (often is oo or more per 100 W B C) (3) a marked epitholiatosis (often is oo or more per 100 W B C) (3) a marked epitholiatosis (often is oo or more per 100 W B C) (3) a marked epitholiatosis (often is one more sepecially the skull. The cortex is thannel and erythropoetic tissue which easies especially the skull. The cortex is thannel and the medullary portion becomes greatly sudened and porous so that in roentgenograms the trabectuale stand out the fine sharp spines. The thicketing of the bone is so great that it gives the patients a characteristic mongoloid physiognomy with high bulgos forehead and prominent malar emmences.

The anaemia is not noted at birth but becomes evident within the first year or two. The disease runs a chronic slowly progressive course and is usually fatal within the first ten years. However some mild cases in adulta have been described. Splenectomy has proved useless and is followed by a great increase in the crythroblistosis (up to 1900).

nucleated red cells per 100 W BC)

MISCELLANEOUS CONDITIONS

Banti's disease is a disease of unknown cause occurring chiefly in young adults, and characterized by the gradual development of a hypochrome namema associated with splenomerally progressive exclines and emacation a tendency to gastric haemorrhages, and a terminal atrophic cirrhosis of the liver, with ascites and jaundice. The anaemia is usually moderate (R B C 3 o Hb 50%) but evidences of red cell regeneration are scantly. At times there are evidences of increased red cell destruction are scantly and the second of the discourage of the frequency of postoperative thromboey tooss and thromboes in this group.

The cases commonly included under this heading constitute a heterogeneous group and many investigators depy the existence of Bantus disease as a definite entity similar pathological changes may follow occlusion of the splenic or portal veins from various causes. The condition should be regarded as a clinical syndrome rather than

various causes Th

Anaemas in young children regariless of their cause often differ from those in adults in the type of cellular response. Immature red cells are more numerous par ticularly normoblasts macroblasts and even megabolists. There is more regularly a leukocytosis of lymphocytosis) which may be market and accompanied by any immature leukocytes. There is often enlargement of the spleen liver and lymph glands due to erythroblasts thyperplass in these organs. The once the spleen liver and lymph for the

POLYCYTHAEMIA

By a polycythaemia or more precisely an erythrocytosis is meant an increase above the normal in the number of red cells per cmm of blood. In a relative polycythaemia there is no increase in the total number of

red cells in the body It is seen chiefly as a transient phenomenon asso crated with dehydration and is a rough measure of its seventy. A local

erythrocytosis may occur as a result of local stasis whether due to chilling and across anosis or to the use of a tournquet

In an absolute polycythacmus there is an increase in the blood volume as well as in the red cell count. There is a pathological increase in the total number of red cells in the body. This occurs (1) in the specific disease crythracmia (polycythacmia vera) and (2) as a compensatory response to anotemia in the following conditions (secondary polycy thacmus).

- 1. Normal Individuals of H 4th All Indix—W thin an hour or two after a sudden access (as a way too) there may be a two of 500 cone of cells per term due to a new pound of cells from the spires which drappears personally after descent to normal levels. With a supurn at they altitudes is some individuals there is an increased production of red cells with a transist non-resculorytes which is stimulated by the low O tension. The ted cell count may reach a million or more in arce instance typical crytharensa has cent of 1 in the higher altitudes in the Anders increable typical crytharensa has cent of 1 in the too preventing crytharensa has cent of 1 in the higher altitudes in the Anders increable is common expectably in Europe in travellers. The preventing crythopics are distincted headsche nauses rapid pulse tachyard a increased respirations and high red blood cell count.
- 2 In chronic myocard al insufficiency with cyanon as in some cases of mitral stenos a and congenital pulmonary stenos s
- 5 In emphysema in diffuse pulm nary fibrous from any cause and in scletons of the pulmonary art rice (Ayerta a disect)
- 4 After mild chron c poisoning with a variety of blood po sons such as lead carbon monoxide sic

Erythraemia, or polycythaemia vera (rubra) is a chronic disease of unknown etiology characterized by an erythrocytosis with an increase in total blood volume by a peculiar intense flushing of the skin and mucous membranes by enlargement of the spicen and by a normoblastic hyperplasia of the erythropoietic tissues. It affects chiefly adults over so years of age. It is characterized chinically by an insidious onset and a protracted chronic course with weakness headaches vertigo transfus paraesthesias nervous irritability and mild mental disturbances. The skin especially of the face and extremities acquires an intense mottled brick red color the mucous membranes a deep purplish red or plum color due to marked dilatation of the superficial capillaries together with slowing of the focal circulation. Haemorrhages and thromboses are common There is often hypertension and resulting myocardial insufficiency Occasionally cirrhosis of the liver develops or arteriolosclerosis of the kidney and renal insufficiency. The basal metabolic rate is increased in about half the cases

The blood at some stage of the disease usually shows a red cell count of 8 million or more rarrily even 12 to 15 million. However the count is not invariably or constantly so high. In undoubted cases it may be between 5 and 6 million. The blood volume is always increased and may be double the normal a decisive point in doubtful cases. The haemo globin is increased to a relatively less degree usually 19 to 24 Gm 130% to 160%. The issuessity is from 2 to 5 times the normal. The midwhuld red cells are somewhat small and pale they show slight anso-cytoms and usually a moderate increase in retrollocy tes and other imma ture forms. Platelets are increased. There is a moderate leulocytosis.

SPIENOMEGAL! IN D SEASES OF THE BLOOD DIFFERENTIAL DIAGNOSIS

				CIFC) C.					59
	Tm fo t Drate	D rat o	Spl no- m galy	Pathol gy f Syl en	Sple t my b fi 1	H m	A mia	Le kocyte	Ю
E	Ad 1s 1 ta	M	SI ght	Fb	و	2	Se ere	Low	
Idap th hypo h m m	. Sign	* *	On I Sight has	~	۶	p	Vod ra to		
P minibaem by pa d	C # 6.1	E'A	* †	Co E on p 2	n n		7 to	low Manny	
p (ti, m qp	h idhood	N ny	7	1 1 1 1 1 1	oft n		, ,		
d 30 M	* po	5 TR	+			5			COSI
od J kach ans m	ad it.	: - - x	‡	-	å		Oh se se	3	OPO
Id p the the mbopen a pu a		g 2 2	~	•	:	1		,	щ
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which may be marked and associated with a slight myelocytosis. Rarely in the terminal stages the blood may show an aplastic snaemia or the presence of myeloblasts and many myelocytes may suggest a myelod leukaemia.

Symptomatic relief with restoration of a normal blood count may follow radiation of the long bones or more certainly the out to as administration of phenythydraxin.

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The resemblance of the cymptoms and changes in the flood similar to those of mountainess has suggested that there is an apparent of the tissues in crythraema Roneier on mechani in for the production of used an anoncamia has yet been demonstrated a cryth that thickening of the alls of the capillance has been demonstrated as considerable for the production of the production of the capillance has been demonstrated. Some record the process as a mall cannot have made an appleamant for the capillance in the capillance has been demonstrated by the capillance and the capillance has been demonstrated by the

Leukopenia — In kala 2222 in which there is usually considerable snaemia (h. most remarkable change in the blood is the leukopen. The feurocy tes are f equently reduced that instead of there bean is white to about 650 red as in a normal p iton, the

pr port on is often a 1500 to 2000 (See p. 268)

Leukaemia — Diseases involving primarily the feucocytes and char acterized by an abnormal proliferation of the leukopoietic tissue and by the appearance in the circulating blood of immature leucocytes with usually a marked increase in the hum

ber of circulating leupocytes are apparently rare among the inhabit ants of tropical countries. Manson Bahr in his text book of Tropical Diseases (1940) does not refer to Leuksemis.

Of the three types of leukaemia occurring in temperate climates termed myelogenous lymphatic or monacytic depending upon which of the leukopoietic tissues is involved apparently only the myelogenous has been reported in the tropics and this form reselve.

been reported in the tropics and this form rarely Chromic myelogenous leukaemia

The blood shows a total leucocyte count which is usually between too oco and goo oco per emm but ared; it may reach 1 or 17 5 million Occasionally 11 is within the range of an ordinary leucocytosis. As a rule the bulk, of the leucocytes are poly morphometers neutrophiles and neutrophilic metamyelocytes (20% to 65%) neutrophilic myslocytes are always present (5% to 96% usually 20% to 56%).



Pic 394 — Ch n my I g nou leu k m n \Sy locht p b ly no phonu l ar b n t c ll n n m blat (C b t)

and basophiles are increased and occasionally either type of cell may be markedly increased (up to 40%) The corresponding types of myelocyte are present, and there may be an occasional primitive melocite or mice blast Pathological leucocytes of bizarre appearance are often found The lymphocytes and monocytes are relatively reduced

DIFFERENTIATION OF THE ANAEMIAS BY THE BLOOD PICTURE

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The platelets are much increased

The red cell count is reduced and is usually from 1 o to 3 o million.

The mean corpuscular volume and haemoglobin content are about

normal Immature red cells are increased and normoblasts are constantly present often in fairly large number rarely a few megaloblasts

DeLangen and Lichtenstein (1936) state that my elogenous leukaemias are regulirly found in the tropics that they are often overlooked or diag nosed as chronic malana with a large splenic tumor. They also say that lymphatic leukaemias are extremely rare and they have never seen a care

in the Dutch Last Indies

Bronchial Spirochaetosis - Since the reporting by Castellani of this type of respiratory disturbance it has been found to be widely distributed in temperate climates as well as tropical ones Johnson in Nigeria reported bronchial spirochactes in 107 of 147 sputa but he notes that these organisms were found in typical cases of acute bronchitis pneumonia pleurisy asthma and pulmonary tuberculosis Castellani has reported various spirochaetes as present (B bronchialis B buccalis B vincents and species of Treponema) and associated with these such organisms as streptococci pneumococci and the fusiform bacillus Clinically he divides the cases into acute and chronic broncho spirochaetosis and the chronic group into (1) muco haemorrhagic or muco purulent haemorrhagic cases (2) types with purulent expectoration and (3) types with putrid expectoration. There is also an asthmatic type and he recognized mixed infections with tuberculosis and broncho mycosis. Many cases show patchy areas of consolidation Castellani has found in treatment arsenic tartar emetic and potassium jodide the drugs of importance. Korthof in Batavia in 96 cases of bronchial disturbance found in the sputum in 29 B tuberculosis and in 6 Treponema bronchiolis DeLangen recog nizes bronchial spirochaetosis as a distinct affection. However Manson Bahr does not seem convinced that this is a disease cutity. David T Smith (1927) concludes that we have a group of unrelated nulmonary conditions in which spirochaetes fusitorm bacilli and cocci are present In hi opinion the spirochaetes in the sputum are identical with those found in the buccal and pharyngeal cavity. He produced spirochaetal infections in laboratory animals by the intratracheal inoculation of gineral spirochaetes of patients with pyorthoea. In 12 ca es of primary bron chiectasis he found the fusiform bacilli and sparochaetes in all. The spirochaetal findings were noted in lung abscess following tonsillectomy other lung abscesses unresolved pneumonias various types of bronchitis bronchiectasis and tuberculosis As would be expected the symptoma tology was protean Brain abscess and empyema are the most important complications see also pp 1100 and 1505

computations see 186 pp 1100 and 1500 Cerebrospund Fever—At the close of the Spanish American War United States infantry troops returning from Cuba were ordered into barracks at 16rt Cook Nebraska where during the cold winter months a large number of recruits were also received into the regiment. Daily direct and military measurers requiring considerable physical evertion were performed. The winter was a cold one and the troops were some what overcrowded in the barracks. A severe epidemic of cerebrospund imminigits with a high mortality took place. The disease was diagnosed

by the writer bacteriologically and at autopsy. When the troops were ordered to proceed to Manila by transport at the time of the Philippian invasion the cpidemic ended. Only a single case of the disease appeared among the troops after their departure from the Fort. The epidemiology of this disease also received exceptional consideration during therecand and the outstanding factors in outbreaks seemed to be fatigue over crowding and lessened sunlight. With the commencement of summer, when the troops could be quartered in tents or buildings open to prevaling winds the prevalence of the disease fell not to return in strious proportion until the following winter with cold wet weather, depressing influence and lack of proper centilation. Zealous officers impair into delay often drilled the men to the point of inducing excessive fatigue particularly raw recruits unaccustomed to strenuous military drill. From the above it would seem that conditions for the occurrence of this disease in the troopics were unifavorable.

However some outbreaks have been reported of considerable size notably in the southern Sudan In Manila in 1925 there were 28 cases and 17 deaths and in the Central American hospitals of the United Fruit

Co in 1027 seven cases with a deaths were reported

One who has never lived in the tropics cannot appreciate the intensiscemfort, and even suffering, of the natives during periods of a marked drop from the usual temperature—even the European hunts up warmer clothing during a typhoon and the natives huddle in their houses closing every avenue of ventilation to keep themselves warm. Depressing influences are somewhat similar whether in Northern Europe or in the tropics.

Curhosis of the Liver -A number of observers have emphasized the trequency of cirrhosis of the liver with ascites among native races subject has been one of especial study by an International Commission for Geographical Pathology The Dutch pathologists and physicians have reported that of the various types of liver cirrhosis observed espe cially in the Dutch East Indies that the Laennec type is the most important Next to this they place luctic cirrhosis or syphilis of the liver and finally cirrhosis resulting from clonorchiasis and schistosomiasis in regions where these conditions are endemic They found the cirrhosis of Laennec exceedingly prevalent in Java and Sumatra and they emphasize that alcohol can play no part in it since the native drinks but little spirituous The etiology of the condition is far from being clear and to what extent chronic malaria may be responsible is not evident Some observers have suggested that the absorption of towns from the large intestine in chronic bacillary dysentery or in amoebic dysentery may be a factor others that it is influenced by the excess of highly and hotly spiced foods The Dutch observers have suggested that it may arise from chronic intoxication in a liver deprived of glycogen or in undernourishment and starvation

Since Mallory and Askanazy have called attention to the presence of copper in cirrhotic livers this has been studied at Batavia. In an occa

sional case an increased amount of copper was found but it was absent in the majority of cases of carrhosis

The chinical picture does not differ from that seen in Europe Many cases were successfully treated with salyrgan and ammonium chloride

In addition to the prevalence of cirrhosis of the liver primary carcinoma of the liver is frequently found in natives frequently associated with previously existing cirrhotic changes

Gall Stones --The rarry of gall stones or of the clinical picture of choleithnasis and cholecystius among the natives of the tropics is well recognized. Kouwenaar found gall stones at autopsy in Javanese males 1887, for females 28% and for Chinese 386% or females 28%.

In Europe the majority of the stones contain cholesterm (from 60-95%) The stones examined in Batavia by DeLangen have been bili ruhin limestif stones containing only from -it's of cholesterin which seldom give rise to chinical symptoms of galbitones and are not facetted as are cholestin stones.

Dental Conditions.—For some reason the dental surgeons practicing in the tropics do not seem to have reported variations in frequency or character of dental diseases from that encountered in temperate climates. This is rather remarkable in view of the influence dietary and hygenic conditions have on the teeth and the explanation of the absence of reports in the literature, may be the lack of time and energy on the part of those best fitted to make observations.

After extensive correspondence with dental officers of the Navy who had served on tropical stations a few facts were gathered for Admiral Stitt by Commander Williams of the Naval Dental Corps

by Commander Williams of the Navai Dental Corps
Harvey failed to note any appreciable difference in the dental infections of white people residing in the tropics from conditions noted at
home. There was often a complaint that cares had developed rapidly
since coming to the tropics but the only basis for such statement was in
connection with coincident bad health from tropical diseases or environ
ment. McCole serving with troops in the tropics during a period of two
years was unable to note any appreciable increase of dental caries. In
the Inhippines and Guam it was noted that the cheaning of bethe dist
which is added a small piece of lime causes marked attrition of the tech
and fissuring of the canadir eaching to the pulp. This increases the
incidence of caries alveolar abscess and diseases of the pulp. The gums
however are more seriously in noticed than the teeth.

Tich v has been impressed with the unusual inflammatory conditions of the straiching tissues of the teeth occurring in those serving, in the tropics. Many persons claim that an existing prorthoca had its inception during tropical service and many complain that an existing pyorrhoca has assumed a more rapid course in the tropics.

The opinion seems general that Vincent's infection is more common and more difficult to treat in the tropics and furthermore the mucous membranes and the gums appear more succeptible to disease and respond more slowly to treatment. This is apparently also true of the healing

of tissues after extraction of teeth, of diseases of the pulp and of pyorhoea McCole reports a marked increase in alveolar abscesses but considers this as related to general body conditions in an unaccustomed environment

Reed makes no comment on the incidence or progress of dental cares in relation to those indigenous or not indigenous to tropical countries but observes that there custs a noticeable difference between dental problems encountered in the tropics and those ordinarily met with in the temperate cones. He enumerates the differences as follows (1) a marked increase in the number of cases of spirochetosis of the mouth (2) a greater virulency and extent in cases observed, (3) a delayed response to ordinary method of medication and increased susceptibility to post operative infection and (4) the failure of accepted methods of treatment in the effort to retain pulpless teeth as useful units of the dental arch.

Diphtheria —Formerly there was an idea that diphtheria like scallet fever was extremely rare or unknown in the tropics. The assistance of the laboratory has shown that this old idea is incorrect and that the disease may be fairly prevalent in many tropical regions. It is more common in the Caucasian race. In tropical Africa according to the reports (from East Africa Ucanda Tanganika and West Africa) it is

rare and only sporadic cases occur

Endocrine Disturbances—Intermsts in all parts of the world are beginning to appreciate that many of the puzzling compliants of ill health are connected with abnormal functioning of the ductiess glands. The conditions resulting from excessive or diminished functioning of the thy roid gland are well understood and the determination of the basis metabolism rate is now a standard laboratory procedure. There are many types of apparatus on the market and the determination is within the reach of any hospital staff.

Hyperthyroidism is now rarely unrecognized as is also true of mytoe dema but sub states of thyroid functioning are less frequently recog nized The association of my xoedema in Chagas disease is discussed in Chapter IV The thyrotoxic heart may be produced by exposure to tropical conditions and may progress to a fatal issue McCarrison has stressed the importance of endocrane disturbances in dietetic deficiencies and notes atrophy of all the glands of internal secretion in such conditions with the exception of the adrenal which tends to hypertrophy is possibly some hypertrophy of the pituitary in males. The ocdema which accompanies most of the food deficiency diseases he associates with the adrenal enlargement and hyperactivity of function although oedema does not invariably result from such hypertrophy In pellagra there is a low blood pressure possibly due to adrenal hypofunction Gottre is found in many parts of the tropical world and Castellam states that this disease is met with frequently in Ceylon and various regions of Africa It is common in some parts of Brazil where Chagas disease is prevalent Disturbances of the internal secretion of the pancreas result ing in diabetes are common in parts of Asia The question of parathyroid dysfunction is discussed under sprue Chap XXXI Sundstroem found that the endocrine glands in the tropics exhibit a decrease of functional activity and thirt therefore a parallel decrease in blood sugar should take place. He observed that this actually occurred in Europeans of both seres who had lived in the tropics since birth. Also a positive correlation was found between the sugar values and feetilism and cholesterol ratios in the blood. DeLanger and Schut in Batavia found that in the newly arrived European the blood sugar was a supmented.

The importance of disturbances of endocrine functions is emphasized in so far as energy is concerned by the studies of Sundstroem and of Radisma on acid base equilibrium basal metabolism. An alkalosis is present in the majority of tropical residents at the height of the hot season and may have an undesirable effect upon their physical well being. However adequate water intake and museular exercise may alleviate this alkalosis. Sundstroem found that the basal metabolism varied between 25 and 36 is calories with an avivage of 31 Variations in the dry and vet bulb temperatures may affect the level of basal metabolism in certain individuals. Radisma concludes that the basal metabolism in Europeans is reduced or 15 at least lower than the standard values which obtain in Europe and America. See also p 1504.

Focal Indections — Attention has been directed to the importance of certain localized bacterial local inition may extend through blood or lymph channels and give rise to various systemic or localized diseases. Most important of these diseases are various types of arthritis together with endocarditis myocarditis and pericarditis. Next in importance are renal

infections chiefly of the glomerulonephritis type

Undersyntis appendictus pancreaturs and various skin lesions may also have origin in a focal infection. The primary foci may be localized in any part of the body but those seated in the tonsilar pendential membrane nasal and accessory sinus tissues are the most common and important Focal infections of the gentio-unnary tract may also give in set or generalized conditions as is also true of such foci in the alimentary tract. In the tonsils we should particularly examine the material of crypts for various streptococci and likewise the bacterial flora of tooth obscesses or pyorrhoea alsowlars.

TABLE SHOWING P UMBER OF TIMES EACH FOCUS (AS CONSIDERED A PROBABLE SQUECE OF INVESTIGATION IN A STREET STREET, BY BLEENES AND ASSOCIATES

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Glanders —This rare disease of Europe and the United States seems to be much more common in many tropical countries. In the Philippines

it sometimes showed itself in the acute form and has been much dreaded by reason of its great infectiousness. See melioidosis. (Chap \lambda \lambda)

Influenza—In temperate climates we associate this disease with bronchial and corj zal manifestations. In the tropics types difficult to recognize are noted especially the gastro-intestinal and a nervous one. The similarity in the clinical picture of dengue with slight emption in tropical influenza is striking. During the last pandemic of influenza there was a frequent complication of influenza pneumonia many casts of this influenza bronchopneumonia resembled plague pneumonia and were sometimes confused with it by the unimitated.

The disease is difficult to recognize during interepidemic periods on account of the lack of any distinctive physical signs. The onset is abrupt with a rapid rise of fever, headache pains in the back and in the call muscles and a rather characteristic screpess of the eve muscles There is a prostration which is often out of proportion to the other manifesta tions and may be prolonged. There may be (rarely) an erythematous eruption There is usually a leukopenia. Influenza, like measles reduces the resistance to other infections, and secondary infections with the pneumococcus streptococcus and Pfeiffer's bacillus are common In fatal cases death is due to these secondary invaders and rarely if ever to the influenza virus alone. In the great pandemics the cases occurring during the first outbreak are generally mild whereas those in the succeed ing outbreaks are attended with a higher mortality owing to the more fre quent and severe secondary infections This lowering of the resistance is indicated by the leukopenia and by the disappearance of the tuberculin reaction The chinical picture in influenza is very similar to that of dengue and the dengue like infections and the diagnosis is particularly difficul in regions where these are prevalent

Liology Bactlus INFLUEAX—(Harmsphilis influen as) was ong sally isolated by Pfeiffer from the spatium and nasal passages of cases of influenza and was believed by him to be the etiological agent of the disease. Recent work, however has established the fact that a filtrable virus is the primary cause of the disease. Shope has shown that typical swine influenza can be produced in swine only when the influenza barulus is inoculated together with the virus of influenza (human or swine) and it is possible that a similar relationship may exist in man. On the other hand, the disease can be transmitted to ferreits by inoculation with the swine or human virus alone, and is not modified by the addition of either the human or porcine influenza basulus.

The evidence at present indicates that if this organism plays any part in the production of the disease it is purely a secondary one and that a filtrable virus is the etiological

agent.

In 1919 Nicolle and Lebailly obtained a disease in monkeys resembling human influenza by intransasi moculation of filtered extracts of the blood and nasal secretions of influenza cases but were unable to carry the infection through a second series of animals

By using a susceptible animal the ferret, Wilson Smith Andrewes and Laidlaw (1933) were able to produce a disease similar to influenza by intransasl inoculation of filtered nasal secretions from influenza patients. They succeeded in transmitting it senally in ferrets by intransasl instillation and by contact. No other method of inoculation produced the disease. In these animals the virus was demonstrated only in the nasal mucous membrane. It is not found in the blood either in the inoculated animals or in human cases of the disease. Serum from these animals after recovery, and from human convalescents neutralized the virus.

And execut al (rosa) also produced the infection in mice by intranasal inoculatio In these animals the virus caused a bronchopneumonia similar to that which frequently occurs in human influenza and the viru was demonstrated in the lungs with or without secondary invaders. The disease in mice was frequently fatal. The virus from human cases was not pathogenic for mice until it had ben established in ferrets and therefore mice are not suitable for isolating the baman us On the other hand both mice a d ferrets are susceptible to the virus of same influenza. Anaesthetization apparently renders the animal more susceptible and predisposes to the de elopment of an extensive pneumonia The vir is isolated by these invest ators from human influenza was shown by cross immunity tests to be related to (but not identical with) the virus of swine influenza. Acc rd ng to Shope an animal which has recovered from either human or swine influenza s immune to both but its sei in protects only against the homologous virus. Swine influenza resembles the human di case also in the association of a Gram negative b cillus (Il mophil enfl en a res) with the irus Shope has shown that the typ cal severe disease in swine depe do up in the combined activity of both the trus and the bacters am. The virus alone causes only an all-defined mild tran sent infection which is often afebrile and the bacillus alone produce, no ill effects

when no uses accorde and the vaccious above produce to sit effects of the observation of winderes a Luidius and Smith (1953) and of Shope There are all others (1955) have been that the viruses so bits ned from recent cases of sometiments of the control of the c

I mm at j.—There is little or no natural immunity to a fluenza as is shown by the c mous much dity at the begin ming of an ep demic. An attack of the disease produces from immunity. This has been regarded as only relative to degree a d of short dura tom because of the occurrence of a success in of out back low two otherse years after each of the great pandemics. If Shope's eas are correct however the acquired immunity must be more is bitantial and endour it plan has been believed. Further many explain the apparent lack. Fur money, if each dive maning cally distinct this may explain the apparent lack. Fur money, if each dive the explaination of the first proportion, is much shown.

Malignant Tumors —It has been stated that malignant tumors are very rare among tropical natives—The proper solution of this question however was complicated by the frequent lack of careful autopsies

Choisser in Haist in a series of 524 consecutive autopsies reported 17 or 324% of the cases dying as a result of malignant neoplissm. Of the tissue number 14 died from carcinoma and 3 from sarcoma (The tissue of ongin of these tumors was as follows 1 from lung 2 uterus r bladder rectum 2 pancreas 4 stomach 3 breast 11 jumph node 1 leg 1 face)

During this period of investigation 342 biopsies were studied from operative material. Out of this number 64 or 1872% proved to be

it sometimes showed itself in the acute form and has been much dreaded by reason of its great infectiousness See melioidosis (Chap \lambda \lambda \rangle)

Influenza—In temperate climates we associate this disease with bronchial and coryzal manifestations. In the tropies types difficult to recognize are noted especially the gastro-intestinal and a nerrous one. The similarity in the climical picture of dengue, with slight emption in tropical influenza is striking. During the last pandemic of influenza there was a frequent complication of influenza preumonia many cases of this influenza bronchopneumonia resembled plague pneumonia, and were sometimes confused with it by the uninitiated.

The disease is difficult to recognize during interepidemic periods on account of the lack of any distinctive physical signs. The onset is abrupt with a rapid rise of fever headache pains in the back and in the call muscles and a rather characteristic soreness of the eye muscles. There is a prostration which is often out of proportion to the other manifesta tions and may be prolonged. There may be (rarely) an erythematous There is usually a leukopenia Influenza like measles reduces the resistance to other infections and secondary infections with the pneumococcus streptococcus and Pfeisfer's bacillus are common In fatal cases death is due to these secondary invaders and rarely if ever to the influenza virus alone. In the great pandemics the cases occurring during the first outbreak are generally mild whereas those in the succeed ing outbreaks are attended with a higher mortality owing to the more fre quent and severe secondary infections This lowering of the resistance is indicated by the leukopenia and by the disappearance of the tuberculin reaction The clinical picture in influenza is very similar to that of dengue and the deugue like infections, and the diagnosis is particularly difficult in regions where these are prevalent

Ettology Bycillus Influenza—(Haemophilus influenza) was ong influenza and was believed by him to be the etiological agent of the disease. Kecent work however has established the fact that a filtrable virus is the primary cause of the disease. Shope has shown that typical swine influenza can be produced in swine only when the influenza bacilist is inoculated together with the virus of influenza (human or swine) and it is possible that a similar relationship may evus in man. On the other hand the disease can be transmitted to ferrets by inoculation with the swine or human virus alone and is not modified by the addition of either

the human or porcine influenza bacillus

The evidence at present indicates that if this organism plays any part in the production of the disease it is purely a secondary one and that a filtrable virus is the chological

In 1919 Nicolle and Lebailly obtained a disease in monkeys resembling human influence by intranasal inoculation of filtered extracts of the blood and nasal secretions of influenza cases but were unable to carry the infection through a second series of animals

By using a susceptible animal the ferret Wilson Smith Andrewes and Laidlaw (1933) were able to produce a disease similar to influenza by quency of gastric carcinomata is emphasized but carcinoma of the oesoph agus is said to be common among the Chinese. The prevalence of skin carcinoma on the legs and feet following chronic ulceration is not common.

In Ceylon the commonest malignant growth in both women and men between 35 and 50 is said to be cancer (epithehoma) of the cheek and to be due to irritation caused by betel chewing. It is also common in South India.

In Kashmir what is termed kangri burn (burn cancer) is found in the older men where it is said that in the mission hospital \$4% of the operations performed are for this condition. The kangri earlthen ware bowl y-6 inches in diameter is surrounded by basket work. It is heated by wood charcoal and is placed or even worn against the skin under a loose garment. The heat given out is estimated at 150-200 F. The entheliomat usually abnear in the scars of previous burns.

In Australia epitheliomata of the face have been reported by Burrows and others in Scottish and Irish immigrants. The growths are said to be

due to excessive irradiation by ultraviolet rays of the sun

Measles—Is not uncommon in a number of tropical countries. There does not seem to be any difference as to the symptoms and childemology of measles whether in the tropics or in temperate climates. There have been numerous records of the devastating effects of the disease when first occurring in a population previously exempt and the usual explanation is that of inherited resistance. Squire in his account of the very fatal epidemic of measles in Fiji in 1874 when some 25 000 Fijians died attributed the great mortality to the fear that seazed the natives who absondend their suck or subjected them to forms of treatment product the of senous complications. He states that we need invoke no special susceptibility of race or peculiarity of constitution to explain the great mortality—thousands were carried off by want of nourshment and care

as well as by dysentery and congestion of the lungs
Mumps—This disesse is found in many parts of the tropics and
presents similar features to the epidemic parotitis of temperate climates
In the Philippines there seem to be cases similar to memos but without the

contagious feature so characteristic of the disease in Europe

Nervous System (Diseases of) — Encephalitis lethargica (Economics disease) has been reported in epidemics in Saranak and in Cochin China Encephalitis (Type B) is common in Japan and is apparently identical with the form found in St. Louis U S A in which there has been absence of ocular lessons. Epidemics of antenor poliomyclitis have been absence of coular lessons. Epidemics of antenor poliomyclitis have been noted in a number of tropical countries and particularly in Africa in Uganda and Kenya Cerebrospinal meningitis bas been referred to above Steping inclines is discussed in Chap III.

Pneumona—just as with the tubercle bacillus so does the black race seem to have less resistance to the Diplocacis: pneumoniae than does the white one Great engineering works employing tropical natives are frequently associated with every fatal epidemics of pneumonia especially.

'cancer, 11 sarcomata and 53 carcinomata. The biopsy neoplasms included the following types of malignant tumors 2 non-melanotic melanomas 3 pigmented melanomas 6 fibro sarcomas 7 squamous cell carcinomas 23 adeno carcinomas and 3 basel cell tumors

The microscopic appearance of the cells of the various cancers differed in no way from that found in neoplasms of temperate climates. Many cell types were reported as anaplastic and apparently of the highest grade of malignancy. In such instances one would expect early diffuse metastase in adjacent and distant organs but it was surprising to observe when dealing with such highly malignant tumors to find that distant metastases were rarely encountered.

It is of interest to note that prior to this investigation cancer in Halt was considered extremely rare as no cases were definitely proven from a microscopic standpoint to have existed. This did not indicate that the incidence of cancer was increasing there, but that scientific investigation had revealed a condition that was ever present but unrecorded.

Some statistics collected by Hoffman showed that eancer was almost eight times more prevalent in European clines than among primitive races. This does not indicate that the primitive man employs an immunity Such variation can be explained by the fact that little or no pathologic study has been done among the primitive and also to the fact that a great proportion of primitive people do not hee to the cancer susceptible age.

Leonard Rogers in a comparison of tumors in Calcutta and London sets the following percentages For Calcutta being tumors 41, malagnant 58 while for London the corresponding percentages are 43 and 57. As regards malignant growths in Calcutta 18% were sarroom and 397 carenoma while the corresponding figures for London were 9 and 47

Some striking variations in frequency of cancers were as follows the first figure referring to Calcutta the second to London Tongue 19-60, throat 03-2 penis, 15-07 cervix 67-18 breast 68-15 uterus

45-17 stomach 04-11 large intestine 07-33

In concluding his study Rogers says that those who proclaim the rarity of malignant growths in matter residents of the tropics must prove their assertions by accurate pathological data such as the figures he has given which in 90% came from native Rengalis hving in villages under primitive conditions and on a duet of natural foods

Malignant growths have also been shown to be common in the Dutch East Indies by DeLangen and Lachtenstein In a sense of 5000 autopuses malignant growths were encountered in 9% and the proportion of six comatous to cancerous tumors was 1 to 39 whereas in some European and American statistics it is 1 to 1000 Sarcomata of the very malignant round cell type predominated Malignant disease of the breast is not uncommon in the East African native and according to Vint in almost 20% of the cases it is found in males O Connor has reported that in Bengal, melanoits caseroms is commoner than in Europe Primary liver carcinoma constitutes 12% of all carcinomata in the tropics (Vint) and in 00% of the cases is associated with currboss (Singleter). The infre

The writer is not familiar with this Brailian disease but be thinks there is a tropical contagous form of prophysican should be caused recognism has not been demonstrated $Top \in AB$ soil s-1 is interesting that the same organism responsible for this more fiduminating less in should be the one responsible for the company composition to land in f or holis are exceedingly common in the tropics. These boils may be larger and with a greater tendency to a videopread distribution and in some regions they are to continuo as to have a regional designation (Nik bold). The staphyleocecur of tropical manufactures of the staphyleocecur of tropical manufactures of the staphyleocecur of tropical manufactures of the staphyleocecur of tropical manufactures of the staphyleocecur of tropical manufactures of the staphyleocecur of tropical manufactures of the staphyleocecur of tropical manufactures of the staphyleocecur of tropical manufactures of the staphyleocecur of tropical manufactures of the staphyleocecur of tropical manufactures of the staphyleocecur of tropical manufactures of the staphyleocecur of tropical manufactures of the staphyleocecur of tropical manufactures of the staphyleocecur of tropical manufactures of the staphyleocecur of tropical manufactures of the staphyleocecur of tropical manufactures of the staphyleocecur of tropical manufactures of the staphyleocecur of the staphyleocecur of tropical manufactures of the staphyleocecur of the staphyleoc

Rabies—This cosmopolitan disease is common in addition to temperate regions in many parts of the Orient India. Allena and parts of ental South America. The South America. It has been shown to be trained ittel by the bits of the vamper but Demodus trained is (Linn. 1924). Rabies is primarily a disease of dopt wolves cats and other carno rous namings but is communicable to man and domesticated aimst through the sal vary secretions. I rabid aimstable the man and other carno executed from the other commonly by lates but infections he are occurred from the licking of apparantly normal salan by rabid dogs.

Epidemiolog cally rabid dogs re almost exclusively the source of infection Rabies has be n erad cated from England by rigid quarantine of tm; orted dogs The s live of the rabi I dow may be I fective five days before the onset of symptoms and remains so until the death of the animal. The first symptoms in the dog are ellige of disposition followed by e citability (e en sciousness) and ending in par lysis and death within to days. Death follows de elopment of symptoms invariably in man and almost invariably in the dog but the disease d es n tal ays develop from the bite. Clothing may bearb the saliva Cornwall reported a series of 4 3 persons bitten by known rabid d gs Of thes ca es 148 d vel ped rabies Lacerated bites about the face neck or up; er ext emit es are the m st serious. In man the period of incubation is from a weeks to 6 mo the usually less than 6 weeks. The first symptoms are strictability and depret on with a live of figure and depret on the live of figure lessness a d hyperaesth The dre d of drinking water (bydrophob a) is due to painful refi x spasm. The temperature canges from on to 102 F. The stage of excitement lasts about 2 or 3 1 vs and 1s f flo ed by a paralytic stage which lasts a few bours and ends in death

Bobbs and erion in death.

Rabits is caused by a new oftr pic if a filtrable through all grades of Derkeleld filters. Inclusion (Negri) bodies are practically always demonstrable within the cyto-plasm of the cerebral cells but it is not know to be whether these bodies represent aggregates.

of the virus or cell I e substanc a formed in response to its presence or (probably) both.

After noculation the ru apparently tra els also by to the eentral network system by way of the aux cyls ders of the peripheral netwer. It has never been demonstrated in the blood. In the dog feeldom in man), the bir aux constantly present in the salva.

and is believed to reach the sale any glands by way of the ner es

The sure scan be prosered for me this surger glocen. If frozen and desiccated trap dly it maintains its virulence but if dred at room temperature it loses its structure within a week. Marked differ mees my rollence occur in amous strains of street wrish and may be produced by adapting it to different speces of hosts but all types are immun logically related.

D ag o'nn —The symptoms a dieath of a rob dion are important points in d agno sus theref e the supercleai amis that all selections from a time in the died of suil develop el necal evil e e 1 the die as and die suthin's glays. If it is killed premuterely the tharacter in the it. I goal changes in the brain may not have developed suif cently to pe mit—dispine is to be m de. When the an mail es: the flead and set i inches of the in e. is all it le removed at die et is the nearest it. I ratory. The head may be pack din in e. or the bian occo be i mos ed sect once d'and plated in equal to a suit of the dispine is the suit of the suit of the suit of the suit of the suit of col.) It is suit preserve it e. or the suit of plane is the suit of the suit of the suit of the color is strain not the nelsus in ('s guil bodiers in the cyt plane all the reliain the brain. These are prest city formatisty present and age chi racteristic of rates.

The Aegra bodies were first described by Vegra in 1903. They are round or o all bod es from a to 2014 in diameter, which are present within the cytoplasm of the cerebral

bronchopneumonia Again in the black races the infection tends to become generalized rather than localized in the lungs. It is more town and insidious in its course than is true of the infection in the white man it has the fatal trend of pneumonia of the aged. Another tendency is to invasion of the meninges. DeLangen has emphasized its prevalence and high mortality in the Malay race in the Dutch East Indies.

Progenic Infections in the Tropics—The frequency of pinchly heat in the tropics and other causes of printing as the bites of insects and mould infections bring about scratching and transfer by the hands of staphylococcal and various other progenic organisms. Furuncioses is very common in the tropics and carbuncles seem to be more frequent than in temperate climates. There seems to be a tendency for these progenic infections to spread more widely and to invade the blood stream than is true in Europe or the United States. There are so many resist ance lowering factors in the tropics as insomnia from the heat or bling insects or skin irritations that may lessen the vitality. The various diseases one is likely to contract in the tropics are many of them associated with a lowered opsonic undex and in the case of denige with its lectopenia. Stitt believes there may be a factor favoring the metastasis of local suppurative conditions to the kidney. Here or other internal organ

Tropical Implies — Under the designation pemphigus conta-josus Manson described a very common skin disease of the tropics. The condition bowers is not the classical pemphigus. A bacteriological examination shows in a fill from a vesselle great numbers of pus cells containing phagocytosed diplococci. Wherey named the organism Dribe coccus pemphigus contaiges of Culturally this organism rescribed Subphicoccus with the name of the containing beautiful to the containing beautiful to the containing th

The disease is markedly contagous in children and is strikingly suto incording to that unless the first lesson is treated immediately the emption may become general sed. A small spot of crythema first appears which rapidly becomes viscular to libe to evering the entire spot is of that there is practically no surrounding inflammatory areal. The diaphanous covering subs off with the slightest touch and leaves under neath a raw looking surface which extends perspectably to form an angry boding the patch an inch or more in diameter. In adults it rarely affects pairs other likelihood and the control of t

unantected
The usual treatment is with bichloride lotions followed by a dusting powder of equal parts of bone acid starch and zinc oxide. An ointment of ammoniated mercury 2^{er} to 5% according to age is the most satisfactory treatment.

Towards (1947) has reported a form of pemphanis known in Brantl by the name of fogo stokegor or with fire and that the closely had been indied with a fixed with a fixed by the fixed by the fixed property of the fixed property of the fixed property of the fixed property of the fixed property of the fixed property of the temperature of the fixed property of the fixed proper

Trovasos V. Bol de la Oficina Sanit Panamer page 910 Sept 1942 †Viera J P. Ibid page 913 Sept 1942

The writer is not familiar with this Brazilian disease but he thinks there is a tropical contagious form of pemphigus in which the causative organism has not been demonstrated Trapical B Is -It is interesting that the same organism responsible for this more fulminating les on should be the one re ponsible for the common cosmopolitan hoil and in fact hoils are exceedingly common in the tropics These boils may be larger and with a greater tendency to widespread distribution and in some regions they are so common as to have a regional designation (Nile boils) The staphylococcus of tropical impetigo stems to have greater virulence than that of the bols. Autogenous vaccines have

sometimes been successful in the treat nent of boils Rabies,-This cosmopolitan disease is common in addition to temperate regions in many ports of the Orient Indi Africa and parts of central South America An unusual paralytic type I rabies in man and in cattle has been reported in Trinidad and also in South America. It has been shown to be transmitted by the hite of the vamoire hat Desm d a rolunda a (Lima 2024) Rabies is primarily a disease of dogs wolves cats and other carmyorous animals, but is communicable to man and domest cated animals through the salivary secrets as f rab d animals. It is spread most commonly by hites but infections have occurred from the beking of apparently normal akin by rabid does

Ep demiologically rapid dogs are almost e clusively the sou ce of infection Rabies has been erad cated from England by rigid quarantine of imported dogs. The saliva of the rabid dog may be infect; e five days before the onset of symptoms and remains so until the death of the named. The first symptoms in the dog are tha ge of disposition followed by excitability (e en iciousness) and ending in paralysis and death within to days. De th follows development of symptoms a variably in man and almost invariably in the dog but the d sease does not always devel so from the bite. Clothi g may absorb the saliva Cornwall reported a series of 423 persons b tien by known rab d dogs. Of these cases 143 de cloped rab es. Lacerated bites about the face neck or upper extrempties are the most serious. In man the per od of incubation is from a weeks to 6 months usually less than 6 weeks. The first symptoms are irrital lity and depre sion with early difficulty in deglutation. These are succeeded by extreme rest lessness and hyperaesthesia. The dre d of drunking water (hydrophob a) is due to par ful reflex stasm. The temperature rang s fron 100 to 02 I. The stage of excitement lasts about a or 3 days and is followed by a paralyt c stage which lasts a few ho rs and ends in death

Rab es is caused by a neurotropic as filtrable through all grades of Berkefeld Inclusion (Negri) bodies are practic by always demonstrable within the cyto pfasm of the cerebral cells but it is t known whether these bodies represent aggregates of th virus or cellular substances form d in re ponse to its presence or (probably) b th After in culation the virus apparently travels slowly to the central nervou aystem by way of the axis cylinders of the peripheral nerves It has never been demo strated

in the blood In the d g (seldom in m n) the views is con tantly present in the saliva

and is believed to reach the salivary glands by way of the ne ves The virus can be p eserved for mo the in 50° glyceria. If froze and desiccated rap dly it maintains its virulence but if dried at room temper ture it loses its irulence within a week. Ma ked differ nees in grulence occur in amous stra ns of street virus and may he produced by adapt: g it to differe t sp cies of hosts but all types are

immunologically related

Dag a -The symptoms and death of a rabid dog are important points in diagnos 5 therefore the suspected a mal should be kept under observation. If rahid the dog will develop cl cle dence of the disease and die within 5 days. If it is killed pre maturely the characteristic histol gire I changes in the beam may not have de eloped aufficie tly to permit a diagnos a to be made. When the animal dies the head and several inches of the eck should be removed and sent t the nearest laborat my The head may he packed in ice r the brain can be tem ed sectio ed and placed in equal pa ts of glycerin and water (Sterilize the diluted glycerin by boiling and allow to co 1) This will preser e the virus f r months. The diagnos s is made by the demon strate n of the cl. on (Negr.) be di s in the cytoplasm of the cells to the brain. These are practically to stantly pr sent and are characters see of rabies

The Arg s bodies were first described by begin in 1903. They are round or o al bodies from r to som in diameter which are present within the cytoplasm of the cerebral

They may be found anya bere in the brain but are most numerous in the following areas in order (1) cornu Ammonis (hippocampus major) (2) region of fissure of Rolando (in the dog crucial aulcus) or (3) cerebellum In street rabies large forms from 18 to 234 may be found whereas in the nerve tissues of animals inoculated with fixed virus only minute forms o Sa or less may be detected. These hodies have been found four to seven days before the moset of symptoms

The Negri bodies may be demonstrated by staining smears of the grey matter of the brain by some Romanowsky method preferably by the Giemsa stain. The smears are made by mashing a thin slice of the outer grey matter rich in ganglion cells with a cover



Fig. 105 -Two nerve cells of h ppocampus major (smear preparation) showing Veers bodies A Veers bod s B inner bod es with 1 the Acg : bod s (Alter Rei hel American Veterina) Revew)

glass against the slide Afterward the cover glass is gently drawn along the slide Impression films may be used. The smears are then stagged in the usual way

The following method of staining is also good The smear is fixed in methyl alcohol

for 2 or 3 minutes washed with water and covered with a stain made by adding a drops of saturated alcoholic solution of basic fuchsin to so ee of distilled water and then adding 2 cc of Loffler's methylene blue solution The stain on the slide is steamed gently washed with water and dried Since the relation of the bodies to the

nerve cells is more or less disturbed in making amears examination of stained sections is preferable. Pix a bit of brain tissue for 5 to 7 hours in Zenker's fluid wash and dehydrate in graded alcohols and chloroform as usual embed in paraffin and cut sections These may be stained with Giemsas stain The Negn bodies are brought out as like red bodies in the blue cytoplasm of the nerve cells It is necessary to differentiate in 93% alcohol

Mann's stain may be used for amears or sections After fixation in methyl alcohol the slides are immersed in the stain for 5 minutes and washed in distilled water. After passing through graded alcohols including two changes of absolute alcohol they are cleared in xylol Better definition can be obtained by staining for from 12 to 24 hours and differentiating with alkaline alcohol (absolute alcohol 30 cc sodium bydroxide to in absolute alcohol 5 ce) After 5 minutes wash in absolute alcohol and then in water t hich may be slightly acidified with acetic acid. Dehydrate and clear in xylol The stain is prepared as follows Methylene blue (Gruebler oo) 100 aqueous solution 35 cc cosin (Gruebler BA) 17 35 cc distilled water 100 tc

By the Lentz method the 3µ sections after removal of the paraffin are flooded with absolute alcohol They are then stained with a o 5% solution of cosin in 60% alcohol for one maute Wash in nater and stain for one minute in Loffler's methylene blue Wash them again in water Apply Lugol's solution to the section for one minute and then differentiate alternately in methyl alcohol and water until the section is pink After washing in water stain again with Löffier a methylene blue for one half minute then wash in water and dry carefully with filter paper. Now differentiate in all aline al ohol (r drop of a 50" solution NaOH in 30 cc absolute alcohol) until the section is pink then quickly differentiate in acid alcohol (a drop 500 acetic acid in 30 cc absolute alcohol) until a slight blue outline to the ganglion cells is obtained. Treat rapidly with absolute alcohol and xylol and mount in balsam. The Negri bod es show as light carmine pink bodies on the light blue ground of the ganglion cells. This method can be used for brain smears al o

In addition to examining for the Negri bodies one may inoculate a rabbit or guinea pig subdura'ly with a salt solution emulsion of the brain. If the virus of rabies is present the socul ted animal will develop symptoms within 3 neeks and Negn b dies can be demonstrated. This procedure ch elss the increace ped diagnosis at d may replace it when decomposition prevents the demonstration of Negn bodies. Contamnating organisms may be killed by the glycens so that inoculations are possible. When from advanced purification or other causes the Negn bod es cannot be found the changes in the Gassenan gangla may give a d agnosis. In hypical feutons the ganglion cells are m er or less completity destroyed and replaced by cell of other types.

Local Treatment—Thorough cauternation of the dog bite wound with pure n tree acts (no offer cautery is effic ent) as soon as possible after the be is imperative even when the Pasteur treatment can be given later. Immunication should be started

immediately after the bite has occurred

Faster Treat ext—By subdural moculation { tabb t in senses the virulence of the virus for rabbits in finally so increased that the rabbits due in six days { t is smoots ble to increase further the virulence of the virus which is the termed fixed virus. The pathogenic power of this virus for other animals is also changed so that it is not apt to case rab ext in meteric subcutaneously.

To attenuate this wrise the spand cord of the ribb is removed and dired over conting plant as a time property and the contingent and a spand cord of the ribb is removed and contingent and a spand cord of the ribb is removed and cord of the ribb is removed and cord of the ribb is removed and the removal of property the view of the ribb is removed and the ribb is re

atorage

Other methods of teatment are

1 The Barris Midded—In this the bain and c relate fro on by means of CO enow
ground up and d ed over H SO, for about two days. The irulence of the irus is
reduced one half. The vius if key t at o C. retains the same potency for at least

ex months 2 The C mming If ethod — In thi th brain is emulsified in saline and dialyzed with formaldehyde solut on. The virus is so attenuated that introcranial inoculation does

formaldehyde solut on The virus is so attenuated that intrecranial inoculation does not produce rabice
3 The Högyes Method - The fresh virule t cord is injected but so d luted in etrength

that it acts as an attenuted virus

A Phe oil of Method - Fe my and more recently bemple has a used virus which
h sheen inactivated by the apol atton of strong (/ r ~) phenol Before injecting

the carbol zed emulsion is d luted to pres reative strength (6 5 "). This method is now sed a tensively for man and for prop) ylactic amminisation f d gs

And able t rum has been p epared by injecting sheep with emulions of rabbit s cord
and brain at first net venously then subcutaneously
cutralizing antibodies but is valuel as for treatment

Rheumatic Fever and Scarlet Fever — From a study of the statistical reports and from the writings of various authorities there would seem to be two cosmopolitin diseases which are of extreme strity in natives in the tropies rheumatic fever and scarlet fever. It is true that in the Gold Coast report for 1911 there mode of 1912 there were noted 614 cases of rheumatic fever with one death. There does not however appear to have been any striking increase in admissions for valvidard disease of the heart as would naturally be expected. In Calcutta in 1911, there were 74 deaths from rheumatic fever.

While acute articular rheumatism is so widely di tributed in many parts of the world it occurs very infrequently among the natives that reside in hot dry dirmates. Rheumatic valvular disease of the heart is cells They may be found anywherein the hrain hut are most numerous in the following areas in order (3) cornu Ammonia (hippocampus major) (2) region of fissure of Rolando (in the dog crucial sudeus) or (3) cerchellum In street raines large forms to 3 to 3 ju may be found whereas in the nerve tissues of animals inoculated with fixed 1 virus only minute forms 0 sport less may be detected. These chodes have been

found four to seven days before the onset of symptoms

The Negri hodies may he demonstrated by staining smears of the grey matter of the brain by some Romanowsky method preferably by the Giemsa stain. The smears are made by mashing a thin slace of the outer grey matter rich in ganglion cells with a cover

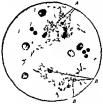


Fig. 395 —Two nerve cells of h ppocampus major (smear preparation) showing Negri bodies. 1 Negri bodies B inner bodies within the Negri bodies (After Reichel American Veterins y Review)

grey maîter rich in ganghon cells with a cover glass against the slide. Afterward the cover glass is gently drawn along the slide. Impression films may be used. The smears

are then stained in the usual way

The following method of staning a take good. The senser is faced in methyl alcohol for a or a minutes washed with water and covered with a stan made by adding along of saturated alcoholic solution of base fuchs not to see of distilled a later and then adding a ce of Lofflers methylme blue solution. The stan on the sides a stranged entity washed with water and dried. Since the relation of the bodies to the

nerte cells is more or less disturbed in making sineerne examination of staned sections is preferable. Fix a bit of brain tissue for 3 to 7 hours in Zenker shud wash and dehydrate in graded alcohols and chloroform as usual embed in parafins and cut sections. These may be stained with Geemsa a stain. The Negri bodies are brought out as lilac red bodies in the blue

cytoplasm of the nerve cells It is necessary to differentiate in 95% alcohol

Mann a stam may be used for amears or sections. After fination in methyl alsolid the sides are immersed in the stam for a minutes and washed in distilled water. After passing through graded alsolids including two changes of absolute alcohol they are cleared in xylo! Detter definition can be obtained by staming for from 12 to 4 bours and differentiating with alkshale alcohol [absolute alcohol or so solution hydroute 1° in absolute alcohol or C. After 5 minutes wash in absolute alcohol and then in water which may be slightly accepted with a feet eard! Debydrate and clear in xylo! The stam is prepared as follows. Methylene him (Gruehler oo) 12° aqueous solution 5 cc. cossi (Ciruebler PA) 1°, 5 cc. destilled water 100 cc.

By the Lentz method the Ja sections after removal of the paraffin are flooded with absolute alcolod. They are then staned with a 0.5% solution of cosm in 60% alcohol for one minute. With in water and stain for one minute in Lofflers methylene blue wash them again in water. Pupply Lugol is solution to the section for one minute and then differentiate alternately in methyl alcohol and water until the section is pirk after washing in water stain agains in his fore smethylene blue for one half immute then wash in water and dry carefully with filter paper. Now differentiate in alkalies alcohol (r drop of a 5% solution NADH in so ce absolute alcohol) until the absolute problem of the solution of the

In addition to examining for the Negri bodies one may inoculate a rabbit or guinea pig subdurally with a salt solution emulsion of the brain. If the virus of rabies is present

tions as latent malaria aprise or discentery to take on activity when the resistance is lowered and in the depre sed mental state and alimentary tract derangement of the sea sick individual such effect may be profound by the all noted the frequency of the vomitting of ascands during a storm showing most dramatically the upset of the alimentary tract. Again we rarely take sea sickness seriously so that a patient who combines some sections illness as permisous malaria, with his sea sickness is not apit to receive proper treatment during the period of the rough weather.

Rutler in an article on sea sickness gives the following facts as to ctrology Due to the observations by James that deal mutes did not suffer from sea sickness, and that of Kreidl in which bilateral section of the 8th nerve prevented the sea sickness syndrome and finally the profound studies of Barany and other during the late war showed that the explana tion of sea sickness rested in disturbances of the movement of the endo lymph in the semicircular canals, the innervating nerve (8th) having connections in the medulla with the cortex cerebellum and anterior horn cells of the cord as well as with the 3rd and 6th nerve nuclei and with the nucleu of the vagus and cells of origin of the phrenic nerve- thus can be explained nystagraus and vomiting Paulty disturbances in the pressure of the endolymph gives rise to seasickness and when one has learned to compensate he acquires sea legs To avoid or lessen sea sickness one should endeay or to make himself as fit as possible before going to sea-the farewell banquet is often the predisposing cause. It is well to eat sparingly and of simple foods for several days before embarking and possibly to take some form of lavative pull. Most of the proprietary remedies have chlorbutanol (chloretone) as a basis but it like bromides or morphine only acts as a depressant—it has no effect on the flow of imput es resulting from varying pressures in the semicircular canals. Dammert's method is supposed to be based on endocrine regulation, but a feature of the treat ment is the administration of atropine a questionable treatment. Percy and Hayden (1028) have recommended large doses of sodium nitrite (3 to 5 grains) every 2 hours until relief is experienced. The theory of this treatment is the depression of vestibular responses but it would seem that the lowering of the blood pre sure was the thief factor. There are of course certain dangers in rapidly lowering blood pressure. It is best to yield to the effects of sea sickness and to assume a recumbent position on the right side with the knees drawn up better in a chair on deck. Some experience relief by taking deep breaths. Chairs which yield to motion in two directions have been recommended

Smallpox —This disease has justly been considered the greatest scourge of the natives of tropical countries. It is re-possible for much of the bladness noted in natives of sections where vaccination has not been employed.

In some of the countries of the Orient smallpox killed more people than cholera plague and dysentery together. Many reports have hown that as many as 80 to 90% of a native population may be attacked in an out break and of these practically one half died. In such communities the

also rate in these localities Manson Bahr (1940) says that there are some who state they have never seen rheumatic fever or endocarditis in a life long experience in India Malaya South China, and Central Africa and MacKinnon reports that chorea was never observed in East African children However, Chesterman, in Central Africa has found it may occasionally occur. Acute rheumatism is sometimes observed in Euro peans residing in tropical countries and in some localities with normal frequency.

As regards scarlet fever, statistical reports from various parts of the tropical world full to show cases. In a report from Shanghai which can hardly be considered as a tropical city, it has been reported that this disease first made its appearance in 1900 since which time it has spread among, the Chinese exhibiting at times marked syndence. Again in Basutoland 67 cases were reported but as this colony is in the extreme south of Africa it could hardly be called tropical.

DeLangen (1936) states scarlet fever does not appear in the East Indees and that while it occurs in northern China and India it does not do so in the southern provinces. In South China Zoller found that the Dick test gave uniformly negative results. In India the disease is rare and of mild type and especially attacks children. Megaw and Das Gupts reported that in India during 3 years scarlet fever was present in 212 districts but these cases were nearly all in Europeans. The few cases reported from Central Africa bave been among, European residents. On the other hand according to Bottlether (1934) sporadic outbreaks have occurred both in South America and the Vect Indies.

The Duk Test—This test is used to determine susceptibility to scaled fever and is carried out in the same manner as the Schick test for diphe theria. Over 80% of adults give a negative reaction to the toru and the therefore a natural antitorin (and perhaps other antibodies) in the blood. The test is usually positive during the early stages of scalled fever and gradually disappears during considerance.

A saline dulution of the standard toxin with a potency of one skin text dose in o ice is used. This is nighted intradermally in the flevor surface of the foresime. Positive reactions appear in from four to take hours and are read in theory four hours. At the height of the positive reaction there is a circumscribed area of redness and inflict tion varying from one to three or four centimeters in diameter according to the succeptibility of the individual. A reaction which has entirely faded in 24 hours is negative Perudoreactions are tare and controls are not necessary.

The Schull Charlion Reaction —Antiscarlatural serum or convolessent seruminietted intradermally in an erythematous area will cause a definite and permanent blanching the surrounding scarlatural rash within five or un boars. They sh omenous due to a local neutralization of the tosin. It occurs only in the scarlet fever examinem and is therefore a useful diagnostic test in doubtful cases.

Sea sickness—This cosmopolitan disease has a particular application for the European visiting the timpies for two reasons (1) It is agit to be first illness encountered in making the voyage to the tropics (2) It may be a serious matter for the tropical resident returning home should be encounter a storm and be sea sick as there is a proneness for such conduction.

DeLangen (1936) reports that in Indo Chains the picture of hemiplegia will symptoms originating from changes in the arteries of the brain and spinal cord may be due to syphilis which is true especially among the Chinese Williams (1938) in Uganda thought that syphilis was responsible for 53 out of 94 cases of heart disease. Aortic syphilis (aortic regurgitation) was present in 86 out of 894 post mortem examinations More precise information on the subject is desarable

Soft chancre is common in many tropical scaports and shows itself in a rather virulent form. In particular it is apt to be complicated by

suppurating buboes

Gonorrhoea is widely spread in the tropics but the extent of its prevalence or the disability it causes is unknown. It is responsible for much ocular and arthritic infection and for much serious disease of female genitalia. In tropical gonorrhoea it would seem that involvement of the

testicles is more common than in temperate climates

Tetanus—S Bayne Jones (1942) points out that as available statistics are incomplete the modence of tetanus is not known in the United States In 1939 for example according to United States Public Health Reports 31 states reported 474 cases of tetanus apparently an occurrence of a small number among several millions of people. It appears that this infection has been far more prevalent in tropical than in temperate climates. It is particularly fatal in infants, the infection occurring from errors in the deressing of the cord at the time of children's

Stitt has seen many cases of tetanus caused by the deep penetration of the barb like tail of the sting ray inflicted on persons wading in shallow waters of parts of the tropics where these Trygondiae are found. These lacerated wounds furnish ideal conditions for contamination with soil and the development of the tetanus backlills. In Central Americas it has

been common after and fles wounds

During the World War the incidence of telanus among the British wounded was about 20 to 30 per 1000 before the routine administration of texanus antitorin when it dropped to 1 or 2 per 1000. In the American wounded where the experience of the British and French was available the incidence was only 0 to feer 1000. Buyer Jones attributes this low incidence in our American expeditionary, forces to prophylactically administered antitioria and also probably to the fact that no large number of our solders fought over the chalks, and manured fields of the Somme region in the sol of which the texanus healths is freought.

Bacters logical Examination of a II out and "Tetanus bacilli can rarely be demonstrated in films made directly from the wound Animal mocu

lation is sometimes more dependable than cultural methods

The wo not should be curetted and some of the tassue f generic assessed into a percent inte out turns or users of the thing for a one a pr. The remail of may be a cultical into glucose age raints or directly on Lodder's about aroun. On this medium the growth f contain, attage organisme on block the testions health to multiply acrobe light of the cultivate the development of a foul sour of it is suggestive. Films from such cultivates frequently above the drums state anover. If these are foul of heat

disease is more one of young children, the adults possessing a certain degree of immunity from attacks in childhood during previous epidemis. It has frequently been noted that the native colored races do not seem to acquire as marked an immunity as is observed among the white races of temperate climates following an attack of the disease. Again it has been insisted that the immunity following vaccination is not as marked as that obtaining Furopean countries. This point would seem not well founded bessel efficient and universal vaccination has apparently caused smallpor in the Philippines to be of no more importance than it is among any other well vaccinated people. It is striking to note the great number of pitted faces among adult Filippines whereas this condition is practically absent in the generation following the general vaccination introduced by the Americans

In tropical natives the most severe forms of smallpox are obserted—donductin and haemorrhagic. Opportunities for the spread of the doneses are most favorable in many parts of the tropical world by reason of intimate association religious festivals and pilgrimages. See p. 1684. Under the name alsatirance of saffir milk, pox a disease similar to a mild.

Under the name deatens or I-affir milk, por a disease similar to a mild form of smallpor has been reported from Airica and the West Indies Various points were raised to differentiate it from smallpor but in a recent epidemic in Jamaica and Haut proof was adduced to demonstrate its identity with smallpor In Haut the epidemic was controlled by vaccination with smallpor vaccine and those individuals exposed to the infection but properly vaccinated, uniformly escaped. Among the solders of the Marine Corps in Hauti there were only two cases and these occurred in men who gave no evidences of successful vaccination. The virus is contained not only in the skin lessons hut also in the nasal and buccal secretions and the disease is communicable before the eruption appears. In spite of the mildness of abstrim it must be regarded as a form of small por and patients isolated and vaccination of contacts and others in the community performed.

Syphilis and Other Venereal Diseases—Syphilis is rampant in many parts of the tropical world Jeanselme has noted that syphilis among tropical natives often starts with an extra gental lesion which tends to become phagedenic and that the secondaries are but slightly marked. It is in the tertuary stage that the disease shows itself in its malignance.

All tropical workers have noted the absence of tabetic and parelic manifestations in the native syphilities. Le Danten notes that he has not observed parasyphilis in any European who had contracted syphilis from a native woman and brings up the question of a difference in strains of syphilis

The American Naval Surgeons at Guam and Samoa have been struck with the absence of primary lessions of syphilis among the native of these islands and Butler has surgested that this side to an immunity received as result of contracting yaws in childhood. There certainly are many reasons for considering syphilia and yaws as closely related and this has been considered in Chapter VI.

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Bacterological Evantination of a Wound — Tetanus bacilli can rarely be demonstrated in films made directly from the wound Animal inocu

lation is sometimes more dependable than cultural methods

The wound should be curetied and some of the trave fraginesis married unto a pocket in the subctaneous I save of the thigh of a part and par. The remainder may be more than the part of t

an emulsion of the growth to 80 C for 1/2 hour to kill non-sporing bacteris and inoculate

a deep glucose agar tube and cultivate anaerobically

A more rapid method is to scal the material obtained in a capillary pipette and heat to 80 C for 15 minutes This can then be plunged into a deep tube of glucose agar which is inoculated along the stab The tube can be covered with sterile liquid petrola tum and incubated However better anaerobiosis can be obtained by the Buchner or Unght method

The filtrate from cultures even when mured can be inoculated into animals (rats or mice) to demonstrate the presence of the toxin This may be the most reliable method for demonstrating the presence of tetanus bacille. A control animal inoculated with the

filtrate together with antitetanic serum should be protective

fulltaxin -The antitoxin is produced by injecting horses with increasing doses of tetanus toxin at first a iding sufficient antitoxin to neutralize it. A high degree of immunity to the toxin is developed. The method of standardization established by law in the U S is based on the work of Rosenau and Anderson at the U S Hygienic Labora tories The antitorin unit is defined as to times the minimal amount of serum necessary to protect a 350 gram guinea pig for 96 hours from 100 VLD of a standard toxin Standard antito un can be obtained from the National Institute of Ifealth by means of which others can determine the strength of their own toxin and indirectly of their anti This unit has relatively ro times the potency of the unit of diphthena antitous

Active immunication of human beings with tetanus toxoid offers the possibility of reducing the incidence of tetanus among troops to a mim According to Bayne Jones the tetanus toxoid at present being employed by the United States Navy and Army is capable after subcutaneous injection of causing human beings to produce tetanus antitoria Within 10 to 21 days after the last of a series of 2 to 3 subcutaneous injections of tovoid individuals have shown from 0 os to 2 5 American units of antitovin per cc of serum The average value is considerably above the level of o 1 to 0 2 unit of antitoxin per c c of serum considered necessary for protection against a toxic infection. A single subcutaneous injection of toxoid administered a month after the last previous injection has a remarkable anamnestic effect in its ability to recall or reactivate the immune response A third dose given 2 to 9 months after the second dose has produced as high as 12 5 American units of antitotin per cc of serum. This response has occurred within 4 to 5 days as has been demonstrated especially by Coules Marvell and Parish Confidence in this immunization procedure is so great that Circular Letters issued by the Surgeons General of the Army and Navy specify that prophylactic injections of tetanus antitown are to be given only to those who have not been vaccinated with toxoid

Our Navy is using alum precipitated tetanus toxoid while the Army is using plain liquid toxoid Allergic reactions may occur after the injection of each type Apparently less after alum precipitated toxoid than after liquid toxoid (Bayne Jones) The reactions which occur appear to be due to the hypersensitivity of certain individuals to proteins of the tetanus bacillus to components of some brands of peptone used for the culture medium or to both

Circular Letter Number 162 Office of The Surgeon General Washing ton, D C November o 1942 gives the following instructions for active immunization against tetanus with tetanus toxoid

- a Type of Toxoid The material used is fluid or plain tetanus toxoid b Method of Immu 1 at on
- Actions of moreons at me.—This count is of a sense of three subcitations in the countries of the most elevation to confidence of the countries
 - (2) Subrequest Injectic s of Tetan s Taxond—After the completion of the three injections included on the initial immunitation a single stimulating dose of 1 cc of tetanus toxond will be 1 jected subcutaneously as follows:

 (a) Under normal conditions a stimulating dose will be administered at the end of the first year only regardless of duration of service.
 - the end of the first year only regardless of oursaion of service (b) A stimulating dose of tetanus toxoid (cc) will be administered during the month prior t departure for a theater of operations unless such departure is within the six months, period subsequent to the completion
 - of the m bal series of three injections or within the nix months period subsequent to the administration of a stimulating dose (c) In add ton to the above initial and subsequent immunisations an emergency stimulating dose will be administered to those indicated below as soon as pract cable after the purye (preferable within three days)
 - Individuals who incur wounds or severe burns on the battle field.

 Patients undergoing secondary perations or man pulations of old wounds when deemed advis ble by the responsible medical officer.
 - wounds when deemed advise ble by the responsible medical officer
 3 Other who incur punctured or lacerated wounds se ere burns or
 other conditions which englit be complicated by the introduction of
 Cl. Islam; into the tissues
- Vol Pas: e Immun hon ago nsi Trianus by the Use of Trianus Initioz n— Tetanus antitosin will be used for the treatment of charcal trianus and when indicated for the prevention of tetanus in and vid als who have not pre iously been actively immunized with tetanus toxoid. The administration of tetanus antitiosin will be limited
- to the f flowing

 (r) To patients present ag evidence of charcal teranus
- (7) To patients present agevidence of chincal fetabus (a) To individually who incur wounds or other conditions which necessitate protect on against tetabus but who have not pre-possity completed the init all immunisation with tetabus toxical as directed in puragraph & above
- (3) To wounded industables who may have been previously immunised but whose rec tes of immunization are lost of not a shable
- Individuals referred to in () and (3) above will be immunised passively with at least 1500 units of telausa autitoria and at the same time will be immunized with tetanus toroid as directed in paragraph 8 above.
- Due consideration should Iways he given to the possibility of sensitivity reactions when injecting fetanus toxoid or tetanus aut fox n

Chincal In fully developed tetanus there is rigidity of neck and jaw muscles (trains) and possibly motolement of lacal muscles (trains surdoneus). Convulsions are apt to follow auditory or tactile stimuli, cyanissis may result from spans of the glotts. There may be moderate lever and leucocytosis. Symbiosis with other anaerobes or with various pogenic organisms ands the development of tetanus hacilt and necrotic tissue is also of importance for which reason debindement became a routine measure during the last World War. Symptoms may appear in about two weeks after infection shorter periods are more often attended by latal results. There is a chronic form of tetanus which may cours several

months or longer after injury, or it may possibly follow late operations in the area involved. The soluble town eliborated in the infected wound may ascend by the axis cylinder of the nerves. Very extensive studies have been carried on with reference to the chemical nature of the tetanus town (tetanospasmin) and how it is transported in the body and how it acts. In the United States they have been carried on especially by John J. Abel Firor and their associates, Mueller, and by Bayne Jones. These studies are too extensive and too diverse to be considered in this ten book. The reader is referred to the article by Bayne Jones (1942) mighther the unportant progress made has been summarized. He reports that the central problem in the chemotherapy of tetanus is the search for chemical antidotes to the poson itself or to the nerve stimulating substances released and attributed through its action.

Treatment - Rest in a darkened quiet room is indicated and it is essential that the patient be kept quiet and relaxed by the use of sedative

drugs to prevent exhaustion

Technical Manual Guides to Therapy for Medical Officers War Department Washington D C March 20 194 advises for treatment

(1) At the appearance of the earliest signs of tetanus immediate therapy is indicated all cases must be treated vicorously

(2) The patient should be secluded if possible in a quiet darkened room

(a) Spasms must be controlled by heavy doses or either parallehyde or chlorid hydrate. Platients with tetabus vary weldy in their response to these drugs and each case must be treated individually. From 8 to 40 oc ce of parallehyde can be given by rectim and this dose can be repeated every a hours. Chloral hydrate can be given in doses of from 1 to 3 ctams either by mouth or rectim in dose can be repeated every a hours or more often in ferestant to control spasms. In severe cases 0.01 to 0.0 gmm (36 to 2 gman) arctin per kilogram of body weight should be given by rectime With all these exclaves, care must be exercised to aword maked respiratory depression. This heavy sedation is continued during the course of the severe phase of tetanus. If respirations occurs it is important to our at maked in respirations.

(4) The primary would should be treated as follows: the area around the 19139 in inflicted with from 5 000 to 1000 units of tetanus antitions due precautions being taken against serum sensitivity. An hour latter the wound is unused and left open foreign bodies must be removed and adequate debriedment carried out when indicated (3) Tetanus antitions must be administered early and in adequate amount. If

- A granula simulation mass is a summisseeze charged to the patient is sensitive to serum desensitization should be carried out then leashly A syringe containing a 1 food solution of epinephine (distrainin) should slasly should be at hand. The scheduled choose for introduction is as folds: 60 counts is given intra-remotely, and as one of the design for introduction is as folds: 60 counts is given intra-remotely contained to the second day and every day, thereafter until define to represent occurs approximately good units is given intravenously. The array consumer and intragamal injections must be given tery slowly. If anaphylactic symptom develop during textainers immediate withdrawal of the needle is imperative and request does to 5 to 1 to cc.) Inf. a 1 room solution of epinephine (adrenalm) should be
- (6) Tracheotomy should be performed if larying all spasm is causing sufficiation (7) A liberal fluid diret (2 000 to 4 000 calones) should be given and the patient must be kept in fluid balance

(8) Constant nursing care should be provided if possible

*S Bayne Jones Tetanus Proceedings of the Institute of Medicine of Chicago 14 No 3 April 15 1942 Serum treatment after symptoms have developed as far less efficacious than that of diphthens largely because the torm has afteredy become faced to the nerve tissues. The nerve cells have a greater affinity for the tixnon than has the antitions and when once injured do not recover, as within 10 days a other body cells. The mortability of untreated cases developin, within 10 days to ver 80°. Baye points out that serum therapy of tetanus is unsatisfactor; at best. Abel and Chalian showed that antitetance serum is powerless to mitigate or abolish evisting and clearly evident symptoms of a descending tetanus in animals and in human being whose tissues band Exed one or more lethal doses of the torm before the serum was used. It is hence obvious that the discovery of a relatively specific chemotherapy is urgently needed.

A few chemotherapeutic experiments have been performed in which sulfandamide and sulfappratione have been applied locally in animals with the idea of destroying the infecting micro-organisms. However Welch Slocum and Herwick.* (1947) have found that sulfandamide contaminated with teclaus spores and implanted in guines pigs will not protect these animals from the development of tetanus. They hence emphasize that the sulfandamide may act as a usive debitant in the presence of the tetanus bacillus and be conductive to the development of tetanus.

Trachoms—It is often stated that this serious and very chronic eye condition is widely prealent in the tropics. It is most frequent in Arabia and Palestine and in Egypt fully 65 per cent of the native population is affected (MacLullan). It is also endemic in Syns. Perma Central Asia China and Japan. It has been prevalent in eastern Europe and especially in Gallipoli. Poland Lithuiania Russia and in southern Italy. The chimate in a number of countries in which it occurs is temperate. In

J: A M A 220 36 October 3 1042

discussing with naval ophthalmologists who have had extensive expenence in the Philippines Haiti and other tropical regions. Stift was informed that the cases diagnosed by many general practitioners as trachoma are really cases of folliculosis and that true trachoma is very rare in these countries—there is not the scaring so characteristic of trachoma. Not only do thes and other insects tend to spread acute epidemic conjunctivities but the abundance of irritating tropical pollens hrings about other conjunctivities inflammations as folliculosis.

The prevention of the entrance of trachoma hy immigrants into this country has been one of the serious problems of the immigration offices

of the public health service

The relation of trachoma to the Prowazek hodies and to the koch Weeks bacillus is still under discussion and this is likewise true of the Gram negative bacillus reported by Roguchi as the cause of trachoma It has even been suggested that trachoma may be another example of a disease where food deficiency furnishes a background if not a cause The reports regarding a ricketisal origin are discussed in Chan NAV post-

Tuberculouss—The negro race seems to possess a greater susceptibil tit to tuberculouss than the white one a fact well recognized in the United States, where the colored population suffers far more severely than their white neighbors. The yellow acces also show marked susceptibility to the seourge and in the Philippines. It seasily the greatest cause of death. The mortality statistics of the Philippine Islands during 10 years compared the relative importance of the two diseases tuberculouss and teprosy. According to this report out of every 1000 inhabitants 541 died in the course of the 10 years from tuberculouss while 0 ay fuel of leprosy.

DeLangen (1936) states that in Netherlands India in earlier years the conclusion stood fourth in the list of causes of death following malaria cholera and typhoid fever. After cholera was largely stamped out it rose to the third place and in the past year has displaced typhoid fever to the second place. He believes that in the near future it will become the most

important cause of death in the East Indies

The rapidity of its spread and the malignancy of its course when it was first introduced in the Pacific Islands has heen vividly described by Robert Louis Stevenson in the Marquesan Islands. Its disastrous spread also occurred elsewhere in these islands notably in Samoa and Tonga Today it is regarded as the chief cause of death not only in the Philippines but in Jamaica and in Africa on the Gold Coast the Congo and in Ranganyila. Scott has shown that there has heen an enormous increase in its prevalence during the last ro years and in some cases as in Nigeria and British Guiana it has increased; and 6 times what it was prevously

In tropical regions the natives of the sea level regions suffer more than those of the mountain plateaus and where the humidity is high rather than in arid sections. Thus tuberculosis is very rare or almost unknown in the dry desert like regions of upper Legypt and the Sahara desert. The disease gains headway in the tropics in the rainy season and dimmisshes in prevalence during the dry season. One factor in the great spread of the

di ease is the intimate contact of natures living together in a small room it is generally recognized that susceptibility is greater in childhood and that infection by way of the alimentary tract is common in children When one notes the habit of expectorating anywhere and everywhere on the part of people untrained in hygenic rules it is easy to recognize

the opportunity babies and young children have of ingesting tuberculous material taken up on their bands while they are crawing about

During the war there was a great deal of tuberculosis among the native African troops serving in France and a study of the disease in these men has furnished us information as to the existence of two chinical types among them. In the soldiers from Morocco and Algers the type observed was similar to that occurring in Europeans and this was explained on the basis of the opportunity that had been given the people of the arcis from which the troops came to acquire tuberculosis from contact with white colonists and during a period of imany years to have acquired a certain degree of resistance to the invasion of the tubercle bacillus.

In connection with the Senegalese troops and some others coming from sections of Africa where tubervilous was rare or noncustent another type was observed which corresponded with the tubervilous one often sees in a young child or a guine; pig. In these cases the disease was believed to start with enlargement of the glands at the roots of the lungs. This view of course would require examination by an X-ray plate for confirmation but it was found that the enlargement of the supraclasivular glands at a point near the insertion of the sternocleudom istord was one of the best early signs. The glandular stage lasted about five to ten weeks during which time the general health did not seem to be materially imparted Following this stage and lasting only about two week. or up to two months a stage of generalized tuberculous set in which ever mentation castosis pneumonia or manifications of miliary tuberculosis. There was no tendency to fibrous or cure of the process death almost unarably occurring. Borrel who studied the disease in these natives states that if put at rest and placed on a generous dest which the case is in the glandular stage one half of them may recover. It was noted that sputtum evaminations of these Cases were almost invariable necessities.

Opic (1941) and his associates have carried out most important studies on the spread of tuberculosis in regro families of Jamaica W I. They found that tuberculosis in the segio race of Jamaica pursues a much more rapid course than that in white people of European extraction and is readily transferred from a person with the disease to other members of the household adults as well as children so that many of them may die of tuberculosis within 2 years after it has been mitroduced into the family

Of those who suffer from pulmonary tuberculosis in Jamaica almost all disseminate tubercle bacilli the proportion of those who have tubercle bacilli the sputum being much greater than that of white persons of the United States (Philadelphia) and greater than that of American negroes

Factors that promote the sprend of the duease in Jamaica are the large number of tubercle bacilli in the sputum of those who suffer with rapidly progressive ulcerating lesions, uncleanly habits unhygienic housing con ditions and lack of facilities for segregation of those who suffer with the disease

In negro adults of Jamaica infiltrating pulmonary lesions of the child hood or first infection type are found more frequently than in American negroes and much more frequently than in white adults (Studies on Tuberculosis the Johns Hopkins Press Balt 1041)

Typhoid Fever—When reliance for diagnosis rested almost solely on clinical manifestations it was held that typhoid fever was rare or unknown in the tropics

Since the advent of laboratory methods of diagnosis it has become known that typhoid and the paratyphoid fevers are quite common. The paratyphoid infections are more common in the tropics than in the temperate regions. The fever course and clinical picture of typhoid in the tropics are sometimes distinctly at pical. It was formerly common to consider cases of typhoid as malaria and in the southern states of the United States it was a common thing to diagnose typho malaria fever. Of course, latent malaria is apt to flare up in a person sick with typhoid but the idea that there was a symptom complex partaking of the characteristics of typhoid fever and malaria is now grouped with historical data.

It is a remarkable fact that in many of the cities of the Orient could tons favoring infection with typhoid fever, such as neglect of the most dementary measures of disposal of facees and lack of safeguarding of water supplies exist and yet the natives seem to have an immunity to organisms causing alimentary tract diseases. If may be that such immunity is acquired by attacks of the disease in childhood. Certainly, Europeans in such communities have no protection unless sometimes it is acquired by vaccination. It should be remembered that protection from vaccination against the enteric group of bacteria can not be relied on for longer than a period of two years. It would seem that typhoid fever in tropical countries is sometimes more serious than in temperate climates—thus the death rate in India has been about twice as great.

In the absence of laboratory tests the chief rehance in the clinical diagnosis of typhoid should rest in the rather gradual onset of a combined fever, with a rather apathetic toxaemia. Of course atypical cases manave a fairly abrupt onset. An important point in the diagnosis is the

rather slow pulse rate for the temperature elevation

Marris': Atropine Test—Manson Bahr (1940) regards the Marris attropine test as of great value in the diagnosis of the enterin group of feers In this test one gives a hypodermic injection of grean 3/3 of atropine sulphate. Should the case be typhoid or praviationally manihumened during the period from 2/3 to go moutles after the nijection. Should there be any use at all it is said to be less than 4/2 beats per munte. In other infections or in normal individuals the

pulse rate drops at first but after 10 or 15 minutes rises to exceed the pulse rate before injection by at least 15 beats per minute or 30 or 40 beats during the period of 25 to 50 minutes following the injection. The writer has no experience in the use of this test in diagno is. It is not clear that it could depend upon any specific phenomena. Stitt and Clough (1938) give the following procedures for laboratory diagnosis.

Laboratory Disg on: Bloom Currors:—Dur ng We fi si such of the disease typhoid bacilly can be soldered from the blood in about 50% of the cases. Positive tributes are obtained in from 50% to 6 % in the second and thard weeks and after that tim the percentage (I lis further: Dee opasies should be identified culturally and by agglutation with typholo partryboled And appratyphold fainteers. Occasionally a strain is not agglut rable when first soldated but becomes so after a few subcultures.

STONE CLESTED ARE SECONDALLY DESCRIPTION TO THE MEASURE SHE WITH A SECONDALLY DESCRIPTION AND A SECONDALLY DESCRIPTION AS THE ASSET OF

URING CULTURES a c positive in about 5% of the cas s after the second week. The unne should be centraling d and the sedment cultured or broth lasks heavily inoculated. Plates of special media should be used unless the unners obtained with

aseptic pr cautions

No patient should be released from 1 lation until cultur's from the unne and facces
after cathoriss and preferably from the bile also are negative. These m thous are
also used to detect carriers.

If sid Test—the the seco of r thand need the Wald test is the chief diagnostic and This should be repeated at instread in order to deter any in reason the titter of the aggittum to Clutters of the registrum to Clutters of the residual to the size of the registrum to the clutters of the residual to the residual

In individuals who have not received typhoid vactice aggletination with a spotdiation of stemp nations a strong ap to son of typhoid fever which is coff most like litter ness as the disease professes. Aggletination in a dil ton of 1-00 or more is practically diseasons of active typh of infection. Carriers may frow some slight agglet nati in but there i no important change in the title of the service on successive extraonations.

If however the not vidual has person sty rece wed typhod vaces a dufficulus arise in the interpretation of a p via egiptimus in test. Within a few days, after section to me the serious values to provide a first size and a leveryer gradual so that over a short person the uter in practically unche, ged. It's chain and swinal dev loop typhod fe er the titer of the serious values are god easier. This how er may occur also in all citizens other than the typhod fevers as few instance in infert in due to the program of ctions other than the typhod fevers as few instances in infert in due to the program of ctions other than the typhod fevers as few instances in infert in due to the program of ctions other than the typhod fevers as few instances in a few instances of the program of the serious of the program of the serious of the serious of the serious and the serious of the serious of the value of the serious of the serious of the value of the desired to the serious of the value of the desired to the serious of the value of the desired to the serious of the value of the desired to the serious of the value of the desired to the program of the serious of the value of the desired to the serious of the value of the desired to the serious of the value of the serious of the serious of the value of the value of the serious of the value of the value of the value of the value of the value of the value of the value of the value of the value of the valu

Prophylactic I accoration -The value of prophylactic vaccination as originally introduced by Wright has been amply demonstrated. The vaccine is prepared in the

usual way and killed by heating to 53 C

For many years most of the typhoid vaccine used in this country and in England was made from a single culture. Rawlings. Isolated by Wright in 1900. Gunnell (1932) has found that some cultures of this strain have become dissociated partially of completely and have lost their virulence for mice \ accines from these cultures did not protect mice from infection with receptly isolated smooth strains as well as did vaccines made from a smooth strain although vaccination with the Pawlings strain still produced somatic and flagellar agglutinins. He concluded therefore that virulent smooth strains should be substituted for the Pawlings strain i r the production of vaccine and that the demonstration of its ability to produce II and O agglutining is not an adequate measure of its immunizing power

This question has been investigated by Colonel Siler and his associates of the Army Medical Corps in an attempt to increase the protective properties of the typhoid vaccine used in the U S 11my In their experiments seven strains were tested three of high virulence and four of low virulence. In cross immunity tests mice vaccinated with virulent organisms were protected to a moch higher degree than those receiving saccines of lon sirulence. Of the sirulent strains tested one (No 58) isolated from a chronic earrier of many years duration was the most effective and this is now used in the prepa ration of the new vaccine. This is a smooth variant with high virulence and immuniting power as tested by the production of active immunity in mice and protective power for

mice of the serum of vaccinated individuals

The employment of agglutination liter as a measure of immunity is unsatisfactory because there is not a close parallelism between them. There is a marked difference in titer in different individuals after vaccination and in a given individual after reaching a peak in about 30 days the agglutinin titer falls rapidly. Immunity may exist in the

absence of accountining

The more satisfactory mouse protection test was therefore used. It was found that with typhoid bacilli of low sirulence such large doses had to be used to kill the controls that the treated mice were overwhelmed with foreign protein before resistance and immunity could be brought into play If a situlent cilcure was used and if the bacilli were suspended in 6% muein and injected intraperitoneally the M L D ranged from 10 to 1000 organisms for the special strain of mice used instead of 100 000 000 to 1 000 000 000 if suspended in Ringer's solution. In testing the protective power of the serum before vaccination a standard dose of culture of 10 000 hving virulent organism was injected. If all the mice succumbed within 72 hours it was assumed that the man was not immune to typhoid fever

Two methods of preparing vaccine were used in one the vaccine was heat killed and preserved with 0 25" tricresol in the other formalinized (0 to) No distinct difference in the immunizing power of these vaccines was demonstrated \ \ \accines were prepared by both methods from a culture of low virulence (the Rawlings intermediate strain which has been used in the Army for years) and from a highly virulent strain

The subjects who had not had typhoid fever and had not been vaccinated previously were divided into four groups. Each received three subcutaneous injections of one of these vaccines The first dose was 500 000 000 and the two subsequent doses t 000 000 000 each A statistical study of the results obtained showed a materially higher degree of protective power for muce when human ammune erum following saccination with virulent organisms was used than with organisms of I to virulence

Formerly a triple vaccine was used in the Army made up of 500 000 000 typhoid bacilli 250 000 000 paraty phoid A bacilli and 250 000 000 paratyphoid B bacilli in 1 cc of vaccine The vaccine now in use contains only typhoid bacilli, 1 000 000 000 per rec The first dose is o 5 ce the second and third rec each The vaccine is mocu lated subcutaneously at intervals of one week

From 1917 to 1924 triple vaccine was used in the Navy Good statistical e idence showed that paratyphoid infections other than cases of food poisoning were rare among naval personnel before paratyphoid vaccine was used. With the vaccine con taining E typhoso alone a larger amount of typhoid antigen can be used without undue risk of severe reactions with presumably greater protection against typhoid fever which

is the infection against which protection is principally required The U.S. Navy personnel receive two courses of three inoculations at intervals of 7 to 10 days four years spart of a vaccine containing approximately one billion typhoid

baccalla per cc The first dose is a 5 cc the second an I third cc each There may be a slight rise in temperature (rarely above for F) with headache and

malarse in about half of those inoculated

Aggluta ansappea in the blood within a few days. By the end of a month titers of 1-640 or 1-1280 are frequently reached. The immunity produc d is hel eved to last for from 2 to 5 years and the re is some evidence that it may last much longer

Neither vaccines nor therapeutic sera b we proved to be of any value in the treat ment of typho diever. The studies of Magrassi (1940) on an alleged typhoid ultravirus are not conclusive

The Paratyphoid Feners - The paratyphoids would seem to be more prevalent in proportion to typhoid in the tropics than in temperate climates thus in India of 1886 British soldiers convalescent from enteric fevers 79t were diagnosed as typhoid 633 as paratyphoid A 136 as paratyphoid B and 326 as enterie cases of uncertain etiology Para typhoid B cases seem more frequent in temperate climates than para typhoid A ones as noted during the war in France Cruickshank and Lafrenais in a study of carriers among the 1886 cases noted above observed that 49 became carriers and of these 34 were from paratyphoid A cases o from typhoid convalescents and 6 from paratyphoid B con valescents. Of 13 chronic carriers (the e carriers excreting organisms after a period of six months) 8 were carriers of paratyphoid A 4 of typhoid and 1 of paratyphoid B This evidence would indicate that paratyphoid A once introduced might spread more widely than the other enteric affections

Clinically paratyphoid A cases often resemble typhoid ones rather closely although as a rule less severe in course. With paratyphoid B the course is less severe than with the other enteric organisms but it often shows an abrupt onset and is frequently similar to that in ca es of meat poisoning This organism and the Cartner bacillus are common excitants of (so-called) ptomaine potsoning. In paratyphoid B cases there is sometimes a tendency for the organism to localize in the pelvis of the kidney or elsewhere and it may cause a broncho-pneumonia

A critical study by Miller brings out the following points. During the war paratyphoid A cases would be at one time more common and at another time paratyphoid B ones The paratyphoid organisms may give rise to as serious manifestations as typhoid which has particularly true of typhoid in the inoculated As a result of the paratyphoid bicilli having a greater tendency to generalize there is less of the localization in the lymphatic tissues of the intestine than with typhoid. As a result many types of paratyphoid are noted Among typhoid types the general mani festations greatly re emble typhoid but haemorrhage and perforation are much less frequent The dysenteric type may in addition be as ociated with general symptoms The nephritic type has been rather frequently noted

this may be of the nature of nephrits or pyelits. There is also a rheumane type and an influent of one and in this latter type there may be respiratory gastrointestinal or nervous symptoms. Miller noted that the infectivity of paraty phoid was very great.

Colon Infections —Such infections seem to be rare in temperate climates other than as localized conditions especially of the urinary bladder Cholecystus is not infrequently due to a colon bacillus infection the tropics however especially following bacillary dysentery we may have a generalized infection which may result in a fatal septicacina. In such cases abscess formation in the Lidneys is usually found Cases diagnosed as mild typhoid fever have as a result of blood cultures been found occasionally to be due to a colon bacteriaemia.

In temperate climates as well as in the tropics pyelitis is often due to a colon infection and probably 10% of cases of appendicitis are caused by the colon bacillus alone although its extremely frequent in association

with streptococci or staphylococci

Alcaligness Feediss (Boeillus Teechis Alkalignes) Infections—Cases similar to typhoid fever have been reported to be due to infection with this member of the typhoid colon group of organisms. It is a not uncommon inhabitant of the intestinal tract and does not appear usually to have any pathogenic action. However it has been soluted from the blood of a few cases which resembled typhoid and has agglutinated (1-50) with the series of such cases, which did not show agglutination for typhoid It has also been under suspicion as the cause of some cases of diarrheed of rhildren. Shearman Hearst and others noted the isolation of B feedis alchaligness from the blood in suspected typhoid cases. The patients showed a sudden onset with slight chill severe headache nausea and occasionally vomiting with aching of the limbs. The fever would last 2 to 5 days ranging from 101° to 102 F with often a second pyrenal period

Varicella —This disease is of common occurrence in the tropics and does not seem to give rise to greater mortality than it does in temperate climates. In the Philippines Stift was struck by the resemblance it beats to cases of varioloid inasimuch as there was frequently noted as many lesions on the face as on the body. In fact he felt sure that the pustular lesions of the face of such cases were those of smallpox, until he later noted typical valuefall seisons on the body.

Vincent's August — While not rare in temperate climates various symbiosis with spirochaetes are fairly common in the tropics. The best known condition is one in which the toosils show somewhat the appearance of a followlar torsillities but vilocration is more common and secter

however, with less evidence of toxzemia

The temperature in a case of pure Vincent's angina rarely exceeds 101°F but if there is a mixed infection with other pyogenic organisms the temperature and other signs of a severe infection may be more marked There is usually more or less swelling of tributary glands. Associated

with the angina or alone there may be a gingrivitis in which the spongy guint more or less resemble those of scurvy or of pyorrhoca alveolaris in fact spirochaetes have been considered as factors in the development of pyorrhoca alveolaris. In the tropics there have been many reports of organisms of the type of those described by Vincent occurring in a form of skin ulceration or in affections of the mucous membranes in addition to the oral ones more particularly the pudendal mucous mem branes. During the World Warmany soldiers were attacked with trench mouth or Vincents infections.

The infections are readily and easily diagnosed by a film stained with any simple antine dye. Care must be taken not to accept such a finding as the sole cause as an underlying diphtheria syphilis or other discressing may be more important.

discussa usay of more maportum

War Wounds —In a rudy of the aronac bacterial flors of war wounds Lawrence found that more than 80° of the durcharges from such wounds showed streptosecen which e-pecially flournised in deep pockets starby-lococci repl cine them in shallow a unda Gram negative bundle war present in egy of sinerars Of them Z of h is considered to the starbest of the starbest of the starbest of the starbest of the starbest of the starbest of the starbest wounds containing the with fundorm bacili do badily on the starbest of the starbe

The pus from wounds infected with anaerobes 1 usually very foul. The most important anaerobe in the d scha ge from gas gangrene wounds a Cl. welch

The anaerob c spore bearing boolin which occurred ith great (requency in wounds during the World Way re coming a nahah teat of the intest and latest of man and other similar and bence are frequently present in fertilized sold. This spores of most of these anaerobes develop in the intestine of many remain valid for years in the soil. C litters from the clothing of the mean in the trenches almost always showed anisothor organized speciality the Wight booling and frequently tetamus busing the soil and strong the soil and strong the strong the soil and strong the same of the strong that the soil was the soil and strong the same of the sam

Isolation of these org misms in pure culture is technically difficult. Repeated pl ting out of cultures is usu-lily in cessary and Kend lileg ris the selection of a single sorts by the Barber technique as essential for obtaining a pure culture. For disappoints

see p 1685

The most important saccharolytic anaerobe which fitments exholydrates vajor couly with the product of each and gas in Clear of an under it the gas bacillus. It was soluted from some ggm of the cases of gas gangene durn gute Woold War S etal other species may also be encountered particularly C orders at any lay, (whome spite). The local treatment of such lac rat of a side should consist of immediate debindement to trender consistions such arother for the growth of the hattern Secondary 1 fections of such lacerated wounds with C works are very common justice tropical continues, and post morter may an a with the organism is free ent.

Technical Manual Guides to Therapy for Med cal Off cers War Department Wash

ington D C No 8 210 March 20 1942 ad ses the following

Gas bacillus Infection a General—The problem of gas bacillus infection is birgely one of prevention and all we not in which which infect on its a possibility abould receive proper surgeal treatment four a) at the earliest possible moment.

b P philarir — S final mode is recommended as the drug of choice the initial done bining 6 ranging (see ranging 1) and an absolvented does a so gram (a gram) every a boars day a d night. This should be e aimsed for p days or until definite threat arent is available in the proof of therapy almost alway eliminates the possible of a particular int c in C reptaines suffamiliantes should be used deceily. It should be a guarde per square inch but not a er to grams (1909 print) for any one person.

- c Treatment (1) General —The primary wound should be opened and all infected tissue should be removed (in occasional cases this may be so extensive as to warrant
- (2) Chemotherapy -(a) Sulfathrazole is recommended at present as the drug of choice
 - (b) The dosage is as follows
 - 1 Initial Dase (Oral) -6 o grams (90 grams)
 - Subsequent Doses (Oral) —1 o gram (15 grams) every 4 hours day and night until the temperature has been normal for 48 hours then o 5 gram (175 grams) every 4 hours day and night until convalescence is completely established
- (3) Serum Therapy Polyvalent gas gangeere antitoun should be used when in the opinion of the medical officer it is indicated. It should be administred in adequate dosage according to the directions inclosed in each individual package.
- (4) Local Chemotherapy—(a) If all grossly tofected tissue cannot be surjically removed sulfathiazole powder thould be applied locally being used in the same way as sulfanilamide powder (b above)
- (6) If all grossly infected tissue appears to have been removed a pa te of and p roade many be applied. This is made by musing a medicinal grade of ann periode with an approximately equal amount of sterile distilled water or hysiologic salite solution to form a smooth creamy supersion, which flows readily to all parts of the wound. The wound is then to seried with a thick layer of oction wet with water saline solution over which is placed a layer of robber eclophane or vascine guars to prevent evaporation. I frieth dersuing should be applied every 1 or x days when out the crudate and old and period with sterile physiologic saline solution and three should be continued until the infection has been controlled.

Section 1

INDEX OF CLINICAL DIAGNOSIS

When a national presents himself, the physician is contracted with the necessity of arriving at a working hypothesis which will ultimately lead to the establishment of a definite diagnosis. The difficulties of precise d agnosis and the augmented risks to life should an erroneous d agnos a be made are recognised and the clinician should allow no sien or symptom to go unchallenged regardless of how ins gnifica t it may seem. On account of the increasingly complex; of lem of diagnosis the physician may incline to depend more and more upon the laboratory and to be tempted to neglect the simpler art of physical diagnosis. The teachings of Osler should ever be kept in mind. To observe

palpate perc sa and auscultate

As Fremont Smith has aptly stated We forget that the accuracy of the laboratory ta often apectous that many a disease annot be detected chemically or serologically and that time and aga n a diagnos a is we tten upon the very countenance of a patient have we but the wit to recognise it. Diagno tician and crimt al detect ve have this in com-mon that fo e h the disc very of a clue is a first and an essential step in the train of teason ng Each in his own field must be quick to sense the possibil ties suggested by the infinitesimal deviation from the no mal the detect we by a blo d stain or a bit of ash the medical man by a tiny gland or a barely palpable spleen. Any square millime ter of body surface may offer a clue. Under apy ropriate circumstances a single macule may arouse a sanicion of typho d or measles or of b cterus endocarditis

It is not the des re to leave the impress on that I borato y aid is not to be sought On the ther hand when intelligently is ed t is of the utmost importance and n av be the only means of c nfirming or establishing a diagnos s. The majority of the diseases more e mmon in trapical countries are of a specific nature and the demonstration of the specific organism decisi e. However one should keep in mind that the patient m y be suffering ir m two or more ds ses and this as especially true in the tropics Practice n the troops often mu t be carned on authout the a d of large libraries and laboratories and it a f rth a reason that there has been us rted this section on aymptom diagnosis. Patt ats seek medical as i for definite reasons and they usually present a group ng of symptoms which when carefully analyzed will be found to be d'agnostic In the following sect: In the vary: a symptoms are d fined and arranged in alphabet cal order. Under each symptom the discuses are listed in which this part cular symptom occurs and different al diag ostic data re included as an aid in arriving at a tentative d gnosis. The gui i ng p inciple in the us of this ect on should be to note all symptoms which has e attracted special attention in a given case ascertain og the diseases in which they occur and concisely to it these diseases as possibilities. In this manner we may g nerally arm e at a tentate e diag os s on the first ex mination Following this procedure one may intelligently apply the necessary laboratory aids to establish the diagnos a definitely. Further obsertation fall symptoms the careful analysis of the temperature cur e the use of the therapeutic tests o a study of the course of the disea may be required in order to arm e ta definite d agripsis and to promost cate with sense of security

Abortion -The expulsion of the foetus before it is sable is a common occurre ce in such diseases as syph ha measles rel p ng fever scarlet fever small nor undulant fever food deficiency diseases in la a cholera and plague

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Albuminuria - Persistent albumiouria is indicative of reval disease. Album uni may occur due to pus blood and vaginal discharges contaminating the urine Excessive rauscular exercise ingestion of large quantities of proteins and prolonged cold baths are common cau es of transient albuminuma Cyclic orthostatic or postural albuminum is fairly common in the young neuro asthenic type of individual. Among the causes of albuminuma the most common are altered blood pressure and altered kidney struc ture Albumunuria t a common finding in infective fevers genito unnary haemorrhage nephritis nephrosis infections of genito unnary system and is of diagnostic aid in yellow fever and blackwater fever. It is indicative of kidney complications in diphthena and scarlet fever

Beribers - The absence of albumin in the urine in henbers is important in differ ential diagnosis from acute nephritis

Rischafter Ferer -In this disease there is a great abundance of albumin with baem)

Albumin diminishes as the color of the urine clears up

Malaria -Albumin was present in 38% of benign tertian infections and 550 of malignant ones at Johns Hopkins Hospital Several observers have recently empha sized the presence of albumin and casts in some 50 per cent of severe quartan Among these are Boyd (1940) Amer Jour Trop Med p 749 I ellow Peter - The disease in which this is of peculiar diagno tic and prognostic

value is yellon fever We expect albumin about the second day with a steady increase in amount during succeeding days of the fever. The degree of oliguna or the intevention of anuria is of greater prognostic value than the degree of albuminums. The albuminuria is of great diagnostic value in differentiating yellow fever from dengue

Amblyopia -Dimness or bluring of vision occasionally occurs in malana and in

quinine therapeusis

Malaria - The plugging of the retinal arteries may lead to blindness which may be tran sent or la ting. The disc in plugging of retinal arteries by plasmodia is grayish red distinguishing it from the pale white di c of quinine ambly opia

Onchocerciasis may a) a lead to disturbances of vi ion and blindness in the advanced stages of the disease from keratitis and chorodoretinitis

Wood alcohol arsenic and bromude poisoning are other cause to be considered Ophthalmoscopic examination should be made in all cases of complaint of dimnes of

VISIO23 Allergy -The natural hypersensitiveness of an individual as contrasted with indu ed hyper-ensitiveness may be manifested by asthma angioneurotic oedema hay fever intermittent hydrarthrosis and urticaria

Amenorrhoea - The absence of menstruction when not a symptom of pregnancy may be produced by the menopause acute infectious diseases anaemia tuberculosis nervous affections alcoholism and it i allo produced by change in climate for some time after arriving in the tropics women may cease to menstruate for no obvious reason other than the change in climate or menorrhagia may develop from the same cause

Anaemia -The deficiency in the quantity of blood (olizaemia) or in the quality as a deficiency in I aemoglobin (oh ochromaemia) or in the diminution of the number of red blood c Ils (oligocythaemia) may be due to local or general conditions. Ansemia is accompanied by loss of energy palpitation cardiac murinur paleness of skin and mucous membranes and other systemic ymptoms depending upon the underlying cause of the anaema. The van den Bergh te t vill differentiate anaemia due to excessive red blood cell destruction from that due to loss of blood from haemorrhage or secondary to other causes In secondary anaema the van den Bergh test is normal while in anae m a due to the rapid destruction of red blood cells it is direct-delayed (regative directpositive indirect) and the quantitative test gives a reading above normal. In excessive red blood cell de truction as in blackwater fever malaria and permicious anaemia this test is of diagnostic value

The cosmopolitan forms of anaemia are discussed in Chapter LIV p 1568

The old idea that tropical life produced an anaemia is no longer held the i ew now being that such anaemic conditions are almost invariably due to ome recognized cause the most resportant of which is malaria Natives of the tropics may appear bleached out but show a normal red count and haemoglobin percentage. Chamberlain's observatio a have shown that a reside or in the tropics of approximately two years has no appreciable influence on the red cell count or haemoglobin content of the blood of white men and that the actinic rays do not s cm t produce anaemia

An alostomiasis -In advanced cases of hookworm disease showing a picture of profound anaemia there may be so few worms present that the method of making diag nos s by finds g o a may he unsuccessful Ancylostomusis s alo g with malaria the disease to be first thought of in connection with anaemia. It may be difficult to differ entiate the anaemia of m lanal cache us from that due to hookworm disease

Bla kaster Fer r - The strik ng feath e of blackwater fever from the condition of the blood 1 the rapid and great reduction in red cells and haemoglobin 43 a result of the haemoglohmuria we may have in a fe days a full of red cells from 4 or 5 million to app oximately r million and of the haemog! bin to 20" The color index is usually about r The bl od is thin and the serum tinged Probably from the excessive haemolysis one does not see degenerated cells as frequently as would be expected

Helm nth c Affet ns -Not only hookwo m disea e but other helminthic

conditions are to be remembered as causes of anaemia. Very important among these are rectal and vesical schistos miasis as well as thit from Japanese schistosomiasis together with he r and lung fluke disease. Even the ordinary r und worm As aris lun bricoides is to be thought of in a tr pical anaemia. Cases of anaemia in which no other demonstrable cause ha been noted have been thought to be due to trichurasis Cases of Diphallob th n I fum ha e s metunes been associated w th severe anaemia hal a ar -Th's disease gives a marked anaemia with an earthy color of the skin. Leucopen a and splenic enl reem at are char etenstic and the finding of para

sites confirmatory

Li er Ab c s -The angemia in liver abscess is sually not so great as the earthy complexion may indicate. The em tat on is greater than the anaemia

Mala al Ca ker a - Although the mah mant tertian infection has the greatest tendency to produce aemia y ta y type may when entrated bring about the more or less pr fo and anaemia with ea thy skin enlarged spleen dysp oe on slight exertion and orderns of the ankles char tensue if malarial c che in

Malia Ferer - This disease is usually followed by a moderate anaemia

O jules - Not inf equently giv s m e in seve e c ses to an anaemia from epistazis and haemorrhages else; here in the body accompanied by a mark d reduction in the number of blood platel ts

Oraco Fee . In this disease there is what might be termed a fulminating pern cious anaemia. The round d or rod shaped o gamism which attacks the red cells seems to be peculiarly acts e n the bone marrow e eru satt gb ne pains be ng sometimes a feature of the disease. There may be a reduction in red cells to one million promise thin a few days Normob! sts are abundant and megaloblasts may be observed in the more severe cases

S ckle-cell A gemia -The red blood c lls may be reduced t 000 000 in the active phase of the disease Nucleated ed cells and basophtha a present There is a leuco cytos s-17-50 thousand Jau dice is generally p esent. Laboratory d gnosis is made by a ding the characteristic c esc t shaped red bl od cell (Limit d to negr es) Spr e-There is considerable reduction in red cells which may fill below 2 000 000

in advanced eases. The white cells may show a slight tendency to leucope in with a relative incre se in lymphocyt's The haemoglobin is n t as much reduced as the red cells so that we obtain a color under of from x t 13 Poikilocytosis and punc tate basophilis are often noted but rarely does one find nucl ated red cells. In a severe case the blood picture is usually in cr cytic like permicious anaemia. Ocea ion ally however it is byp chromic. The eosinophiles re rare or absent as the case advances One often finds many (7-9) nodes in the polymorphonuclears. The response to oral treatment with live extract is not so un form and r pid as in the dd sonian permicious anaemia

Trop cal dyse terres are often respons ble for anaemia

Tryp nosomias s-As the disease progresses a secondary anaemia may result The leucocyt count is usually normal but the diff rential count usually shows an

increase in the large mononuclears. Bacterial infections often supervene when a leucocytosis will be noted

Anaemia Pernicious -- Insidious onset no marked malnutrition lemon vellow tint to skin ga trointestinal disturbances characteristic red raw tongue and neurological manifestations. The following laboratory procedures are nece sary to e tablish the diagnosis complete blood picture including haemoglobin estimation fracility test and reticulated count van den Bergh test and stomach analysis after histamin see p 1573 The following procedure is an excellent one in a case of doubtful diagnosis Administer daily 400 to 600 gms of liver or its convalent of liver extract over a period and make a reticulated count every other day the reticulated red blood cells should show a steady merease up to the 7th or 9th day then begin to decline at the non relicu lated red blood cells increa e up to about 3 500 000 with a reticulated count at this stage of 2 or 300 This phenomenon when occurring proves the cotency of the liver estract and the diagnosis. If it does not occur the diagnosis is in error or the liver extract is not potent

Anuria. - In anuria we have a cessation of renal function

Cholera -The disease in which anuria is most characteristic is cholera. During the stage of evacuation the urmary secretion becomes less and less there is along with the progressive failure of circulation and during the aleid stage a suppression of unne. The anuria acems to run parallel with an acidosis and intravenous injections of bicarbonate of soda solutions tend to prevent anums. In the stage of reaction the favorable outcome is the reappearance of urine which increases in amount to become a polyuna In unfavorable cases the anuma continues

Bersbers - In dropsical beribers there is an ofigura or varely an anuma which with the rapid disappearance of the general body ordems may become an excessive polyuna

Bluck Later Fever - In blackwater fever anuna may result from the blocking up of the renal tubules by haemoglobin casts Acidosis is present and alkaline treatment is then indicated The urine is irritating so that there is vesical tenesmus with freque ! urination

Heat Sitoke - Oliguria or anuna is common and may be followed during con valescence by a polyuna Marked irritation of the bladder associated with suppres

sion of sweating may be indicative of oncoming heat stroke

I ellow Ferer -The degree of renal involvement is of great prognostic value in sellow fever and those ca es where the obguna goes on to suppression are apt to terminate latally

Ascites -An accumulation of fluid in the peritoneal cavity. The causes of ascites in the order of their frequency are (1) Cardiac failure (2) Renal disease (3) Cirib vis of the liver (4) Tuberculous peritonitis (5) Abdominal tumors both malignant and benign. Other etiologic factors to be considered are intestinal obstruction peri cardial adhesions permicious anaemia visceral syphilis thrombosis of the inferior vena cava tumors of kidney perisplentis perihepatitis peritoneal adhesions hook worm di ease echinococcus disease eclampsia ovanan cysts and tumors

In cardiac failure cirrhosis of the liver and renal failure the fluid frequently actu mulates with great rapidity with as much as thirty to fifty ounces daily Tuberculous perstanitis as a rule shows a more gradual rate positily five or six ounces daily

The diagnosis of ascites as a rule can be made on the presence of painle a distention moveable duliness smooth shiny skip surface broadening of the base of the thates obliteration or distention of the navel enlargement of the superficial veins and fluc tuation on palpation

Some of the conditions which must be distinguished from ascites are (r) O'esity of abdomen in this condition there may actually he a percussion wave on tapping the flanks but there is no duliness in the flank (2) Tympenites no per ussion wave no changeable duliness and the \ ray findings serve to differentiate this condition Cysts the enlargement due to cyst is frequently undateral as in cyst involving the kidney or the overy and it may be possible to outline the cyst and even move it about (4) Choleperstoneum due to rupture of bile duct or perforation of gall bladder the history of the case the occurrence of pain and a history of frauma or preceding gallstone attack should differentiate (g) Haemopertionerum blood in peritoneal cavity may be due to ratin uterine pergancy cupiture of a wines required of an bolomical ansurying router of a nines required of an bolomical ansurying representation of the control of the control of the control of the blooder may also samulate acutes but the character of the tumor ma is uper abapted with electrion of the tympamite more in the flanks. This supperts a distant of the control of the tumor of the control of the tumor of the control of the contro

Beribers.-See oedema and neuritis

Bitchwater Fever - Haemoglobusura jaunduce enlarged splem early vomiting and history of mala in The hiemoglobusura jaunduce enlarged splem early vomiting and history of mala in The hiemoglobusure port wine-colored up-spe couring in a pattent previously ill with malaria a particulty pathogenome. Examine filtram a pattent previously for them globus and methicamoglobus or by benediane or outnotedudine text. Examine filtram and for malarial praises as of melai pricous licitocytes hided sterum for haemoglobus and hibrishis (Van den Bergh text) and for metihae nal humin by the spectores p. tests.) Donagh Landsteiner test negative.

Blood Pressure low -- See hypotension

Bona Affections — The hones become soft in rickets and ostcomalacia hrittle in general pare is takes dorsals and in the senile — Val grancy must be considered when hone is invaded by a pathological process — Funçous infections (Action myces) syphilis has a and ferrowy are common causes of home affections;

A nhum -In this di ease there is thin ing or absorption of the hones of the t e A

Shrout cord replaces the boy structures

By Heid - There has been obsert ord matures of the Gold Coast an affection of the

os cales somewhat like that my frong the superior was flirly bones in goundou. The
dute set begins with pain and tendrioness of o or to both heels. The enlargement may

navel only one os cales or affect both bones. There is no joint involvement but

lecontopin in interfe of with. There are periods of improvement hat heart followed by

return of the pairs

G widow—In gound is the naish bones and the naish proce es of the sup nor
manila are the stat of 13 monthreal swellings of the n ture of a hypertrophic ostents.

These contones may be quite large so that there is interference with vision. There is
that or no 19 is connected with the bony growths and there is no lyans a tendency

and you span contexts and the consistency of the street of the context of the con

Bub — The gift in equive I hope has a basic scompaned by . I farmatory changes and frequently end of general I hope has been and frequently and the properties in the stromage in the grown and and a vin red bub in generally appropriate in the stromage in the grown and frequently strong and frequently of the grown and frequently of the grown and grown and the grown

Chill—Clin cally e pure chill be repor consist of a shivener, shaling or solden terms of the voluntary matrices of averying dustation accompanied by semations of call and often accompaned or followed by an ele ant not temperature. A defaute chill followed by an elevant not temperature an aprecisely shaling person is generally followed by an elevant not temperature as a precisely shaling serious is generally and the state of the state of the state of recurring chils that has symptom as of defaute via the state of the state of the state of the state of the state of defaute via the state of the stat

repeated attacks of rigors and a chill may follow catheterization without infection Sepais peritoritis osteomychitis and erysipelas as a rule have an initial chill Proton shock is a common cause of chill

Cabot states that chills without any abnormal physical signs and with a normal blood picture are most often due to sepsis in the kidney liver or bile ducts

DISEASES WITH RECURRING CHILL

Leishmaniasis — Indefinite onset possibly daily chill remuttent fever with a double rise in 24 hours This double ri e is characteristic and assists in differentiating typhoid and undulant fever.

Malaria — The paroxysm of beings tertian usually commences with malase and sight headacts followed by chilly enerations attained from the spanic cloums to the extremities which give may to actual chill with shaking of body and chattering of test punched face expansions and cuts ancerna. If the rectal temperature is taken like found that the fever has already begun yet the patient desires wraps. As the chill subsides the face becomes flushed and blankets are exat sade and the elevation of temperature may be 104 or 105 f. This fever stage lasts from four to ax hours and to followed by a awarding stage. The chills tend to recur at requir interval the time depending upon the type of organism. The finding of plasmodia in the blood confirms the diagnosis. In subtration malaria, there are often blind child.

Pyelitis stone in the common duct and infective endocarditis may give rise to recur

ring chills with intermittent or remittent fever

Septicopiemia is characterized by recurrent chills without regularity. These may occur daily or every other day. The finding of foct of infection or focal signs of embolt with a high leucecyte count and the blood negative for plasmodia should differentiate from malara. Enlarged soleen is common in both conditions.

DISEASES IN WITIGH INITIAL CRILL HELPS IN DIAGNOSIS

Initial chill with rapid rise in temperature is observed in rat bite fever infectious jaundice, tularaemia and typhus fever

Filterisar — Elephanton fever at times has sudden onset with rigors and high fever terminating with profines aversing. Redness of legs or section accompanied by lymphangins and painful lymph slands should be sufficient to differentiate from making Filianal infection is confirmed by finding of enthrys on Blood film. The position of this condition being an allerge manifestation has been mentioned. It is most likely a bacterial lymphangitis engarded on the filtransis.

Preumona Lobar — In no disease is an initial full so constant and severe and of such early diagnostic aid. Chill fever pain in side cough short rapid respiration guished cheeks blood tinged rusty tenacious sputum is practically pathognoment.

This disease is a common cause of death in the tropics

Spatted Ferer of the Rocky Wountains—Sudden onset with severe chill also use of temperature enlarged sphern photophoba and joint pains. The typical eruption appears from second to fifth day of the disease and is an aid in diagnosis. Typhas often shows a more abrupt use of temperature than Rocky Mountain fever. These tax conditions show a more abrupt use of temperature than Rocky Mountain fever. These tax conditions show a marked resemblance and laboratory and is necessary to differentiate.

DISEASES IN WEICH CERTAIN SYMPTOMS MAY BE CONFUSED WITH CHILL

Cholera—Chili is uncommon but the surface temperature is low while that of the rectum may be to higher Algid perintons malana may be confued with cholera but in malana the axillary temperature is high and the diarrhoea is not so profuse List Absent —Shows an examing use of temperature with sweating which is not

preceded by a chill Marked rigors are rare but have been reported shortly before rupture X ray may be of value in differential diagnosis

Cacherna—Malautrition with a marked state of general ill health is found following repeated attacks of malarna and in hookworm disease syphilis pelligra malignancy and in the terminal stage of many diseases as kala azar. In the terminal stage of a disease it is of slight diagnostic value. Cacherna occurs farily early in carcinoma of the

stomach and produces marked malnutration with anaemia. In syphilis there is usually the history of infection and a politive blood serum react on

Ancylorlomias e -- Physical and mental retardation bitle energy or initiative is a common complaint. The decrease in red blood cells may reach 2 000 000. Eosino pb lia is characteristic and may reach 35". This one finding alone should suggest an examination of faeces for ova or parasites Howe er eosi ophilia is usual in other belminthic infections

Molaria -History of repeated attacks retinal baem ribages enlarged spleen enlarged h er Therapeutic test and the finding of the pfa modia in the blood are diagnostic. The cachegia of both bookworm di ease and of malaria may sho v marked a emia swelling about the ankles palpitation and sh tness of breath. Finding of ova in faeces is diagnost c of the former Cosmophilia is significant in ho kworm

infection and is not found in malaria

Pell era -There is a wasting of all org as and tissues so that emacration in this di ease is marked. The localized symmetrical delimited striking skin crupt on or pigmentation is characteristic. History of previous gastroin testinal tract disturbances and the neurological manifestations should cause one to suspect pellagra

Syphil's -The history or presence of an initial le ion anaemia icteroid tinting of skin no its e Kahr reaction would suggest syphiles as the cause of the cachevia Other conditions to consider would be in the order named dysentery scurvy

chronic alcoholism trichmosis and carrhos s of the is er Cholera -- This disease is characterized by state of evacuation collapse evanosis p ched face cold clammy skin diarrhoes hi h red hi od c unt con entrated blood low hl od pressure. The difference between surface temperature and rectal temperature.

may be ro F Lab ratory Diag asss -(1) Pecove y of cholera vihrio (2) Agglutination tests

(1) Cholera red reaction Chyluria.-Vesical varices f on lymphatic obstruction due to filarial disease are the most frequent c use of the milky urme of chyluna. The urme usually has a pinkish time fr m blood admixture s that the condition is really a baemato chyluria. The thorace duct may not be the seat of ob tructio which has take place elsewhere when the cond tion is lymphuris instead of chyluria Lymph and chyle differ in fat content the former ha ng fr m ery httle t about 30 while the latter has 50 or more femuls fed fat. Chyle has also mor than twice a much proteid as does lymph In chylur, the morning urine is often clear while that at night is milky. On standing chylous unne separ tes into an upper er am like laye with a pinki h sediment ind between a punkish white flu d in which floats a clot. Centrifuge the urine. Filarial embryos may or may not be found in th unine Sometimes they are present in the blood

Coma -A loss of c asciousness from which the pat ent cannot b a oused may be he due to alcohol apoplexy diabetes pernicious mal ria uraem p soning hycertain drups sunstroke and eclamosia. See deli ium and coma

Convulsions - Para yems of gene abzed muscular contractio is may occ r in tetany nickets alcoholism arse c pois ning tetanu epilepsy meningit s b at str ke b ain lesions and eclamps In childe a especially in scorp a po soning Cramps -A painful inv luntary muscular e traction m y follow over-eve tio

d s a common phen menon n athl tes also it is a promunent I ature of cholera II I Exhaust -Severe m sele cramps of leg and at domen occur See del num

and coma

Telany -It is in this condition that cramps a e so el aracter suc a d'diagnost c the fingers are flexed at metacarpal joints and terminal phalapres neighly extended while the thumb is fie d across the palm. The wrists and clooks are flexed and arms h ld rigidly across chest. The feet tur ed in and the foot arched. This position is pract cally diag stic (Martin a sign)

Cyanosis.-Blueness of the skin or p splish to that t at of the f ce is a common symptom of card efailure acute alcoholism asthma asphyxia of drowning crythrae m a with scleros s of the pumonary artery (Ayerza a disease) carbon monoxide p son

ing foreign bodies in the air passages apoplexy tetanus and tetany

Cholera -- As cyanosis develops the red count goes up even to 8 000 000 with a corresponding or greater increase in the leucocyte count. The estimation of the low blood pressure is important as indicating the necessity for intravenous injections The determination of the degree of serum acidosis is also indicated with reference to alkaline treatment. In a convalencent from a disease suspected as cholera an agglutination test would be of value and in the absence of the serum of immunited animals one could use that of a cholera convalescent against a spiritum isolated from the stool of a suspected case of cholera Films from flecks in nice water stools usually show many vibrios with fish in stream appearance. Identify by culture and aggin tination test with cholera immune serum

Plasmochin -The most important toxic manifestation of plasmochin is cyanosis without dysphoea A methaemorlobinaemia results and cases have been reported when the symptoms were much like those of blackwater fever with methaemoglobiouna

jaundice and very great red cell destruction

Death Sudden Causes of - Coronary occlusion angina pectoris cerebral baemor thage rupture of aneuryam apostroke shock dishetic coma uraemia valvular disease of the heart especially agrice and supture of a viscus Sudden emotional trauma

may result in death

Diarrhoea - Frequency of defecation is not necessarily diarrhoea. The essential factor in diarrhoes is the abnormally rapid passage of food residue through the sh mentary canal accompanied by find stools An acute onset suggests a toric or infective origin while a gradual onset in a middle aged individual suggests new growth. Diar rhoes may be due to mechanical or chemical stimulation of gastric motor activity Nervous fermentative fatty chylous and putrefactive diarrhoeas are recognised Sprue or new growths may originate diarrhoeas See dysentery The chronic diar rhoesa of the tropics are often associated with amoebic dysentery and in such ca to we generally get a history of recurring attacks of diarrhoea separated by periods of constipation

In sprue the condition generally sets in as a morning diarrhoea very profuse and painless Hill diarrhoea also shows frequent stools of whitish color from early morning until about noon The typical stool of aprue is a gas permeated putty-colored offen sive mass extraordinantly copious

In cholera the rice water atool which is not attended by pain causes an unusual

sense of prostration even at the quset of the stage of evacuation

In pellagra we often have a recurring diarrhoca or mild manifestations of dysentery The atool of pellagra is darker and less copious than that of sprue and shows only a normal fat content while that of sprue is very fatty-as much as 30% of ingested fat may

appear in the sprue stool as against about 59 for the normal one In Japanese schistosomiasis or katayama disease following the stage of urticanal

fever the microscopical examination of the blood tinged bit of mucus (which often caps the stool) for the spineless ova of the linke is the most favorable measure for determining the diagnosis The diarrhoea may be intermittent The fluke diseases of the liver and intestines give rise to various disturbances The

diagnosis is made by finding the specific ova in the stools

In infections with Strongyloides stercorafts there may be vague manifestations of neurasthema and diarrhoeal disturbances Cochin China diarrhoea was in earlier years regarded as a Strong loides infection and this parasite is often found in distribueal cases in that country and elsewhere in the world

Intestinal flagellates are so common in the stools of well people in the tropics that one should be very careful in assigning a pathogenic role to them It is now accepted by

many that Gardia lamblia can bring about exhausting diarrhoea

After the repeated examination of the facers without finding ava or parasites one should think of tuberculosis syphilis ulcerative colitis and such other causes of diarrhoea as sprue and pellagra.

Tetany - The calcium of the body is utilized to combine with fatty acids to form calcium soap in chylous and fatty diarrhoea thereby diminishing the blood calcium and tetany results Scott having found a deficiency of the calcium in the blood in sprue has suggested guving calcium and parathyroid in this disease

Delirium and Coms -It is difficult to make a sharp distinct: a between a disease showing deligning and one showing come as del nous states tend to be followed by come or such conditions may alternate

Chaira - Follo vi g upon the algod stage of cholers we may have a stage of reaction without the reappear ace of the urine in which a typhoid state with low muttering delirium or even with an acute delirions state supervenes

Disente v-In very toxic cases of bacillary dysentery there may be a mild del mm

Heat Strate - There may be no more difficult problem encounte ed in the tropics than the one of differentiating cerel ral malaria f om heat stroke. In heat stroke we may be eather del sum or coma

Mali us - In the ordinary paroxysm of malignant tertian there is duite a tendency to flightiness duri g the prolonged hot stage. In the cerebral types of permicious malaria there may be violent delirium followed by come or the patient may be comatose from the onset of the naroxysm. Such conditions are often mistaken for suo stroke In the comatose form of m lama we have a h h temperature with sighing or stertorous breath; g and at times Cheyne Stokes re piration

O ora Feo r - Debrum is often oted Marked anaemia pregular fever pain in the bones enlarged spleen and delinum should make one think of Oroya fever but the d agnosis can be definitely made only by the bi od examination and the finding of

Bario ella in the red corpuscles

Pellarra - Comatose states following upon the acute confusional psychoses of pellagra are not uncommon Pellagra may show an acute collapse delirium

Place -In all sue ther is more of a mild definious state in which the patient has a great tendency to nander about The mental state is rather that of an intoxicated person with the thickness of speech and retardation of mental proces es

R & Bite Fee r - Dehrum is a common finding in rat bite fever

Spotted Fener of the Ro ky Mon tos tends to produce stuporous states

T yeanes m ass -Toward the end of the sleeping sickness stage we have a sub

normal temperature with a comatose state Truis reams she - A delimous state especially at night is often noted in tautauga

mush Typh s Ferer - In typhus fe er (tabardillo) del nous or stupo ous states are to be expected about the end of the first week a even e river. This is a disease in which the cloud g of the consciousness is a most as marked as a plague. Debrium is more ant to occur at might

In the above nicciso is the origin of the deligium or come is determined by the discovery of the specific orga sm In pellagra the ne vous and mental symptoms associated with the cutaneous lesions are often of assistance in diagnosis, while in spotted fe er tsutsugamushi a d typhus fever the Well felix reaction may be of val e in diagnosis (See p 945)

I lloss Ferer -- In yellow for r the abert auspicious mental state may give way to

one of ma ked delir um requiring close watching to pre ent the put ent throwing himself from his bed (See p 808 for diagnosis)

Dengue - See tempe ature

Dysentery - The designat on dyse tery refers to a symptom complex (1) Small frequently pass d mucous or much sanguinolent stools () Pain connected with spasm of the sphincter ans (tenesmu) a distestin I gript g (tormina) The condition may be set up by different caus a but bacillary and amoebic dysentery so outwerth the other causes that they sh uld mmed ately be thought of when the term is used. See diarrhoea

Am eb c Dy entery - D agnosis (1) Fx mine stool for Endam eba hi ! lilica (2) Study of cellular exudate from stool will help differentiate bacillary dysentery Usually no fever or toxaem a 1st amorbic desentery

Bacullary Dysent y -This disease is characterized by (1) Frequent so nty sto is of muco purul nt or muco-sa guinolent character () Marked t zaemia and exhaust n (3) El v non ol temperature ros in sog F Diagnosis should be confirmed by isolation of the dysentery bacille See p 568

In cholera we have a profuse diarrhoea of rice water stools without colic or tenesmis Laboratory And - Culture from atool examination of cellular exudate is character istic and will differentiate bacillary from amoebic disentery. Tuberculosis cancerous and syphilitic processes as well as helminthic and other protozoal infections should be

considered

Dyspnoes -Difficult or labored breathing may be expiratory or inspiratory and may be due to cardiac renal acidotic or other causes. In dyspnoea the accessory muscles of respiration are often brought into play and in marked dyspaces the slice nasae dilate and contract with each respiratory effort

The common causes of dyapnoca are Tuberculosis pneumonia cardiac decompensa tion asthma acidosis (diabetes mellitus) anaemia pulmonary eongestion tumors and

Tropical conditions causing dysphoca are Typhoid trichinosis tetany tetanus

rickets scurry glanders beriberi pneumonic plague and allergic manifestations It should be kept in mind that in cardiac dysphora the work of the heart is lessened when the patient is propped up or even leaning forward, which phenomenon may be of

diagnostic value

Eosmophiha - Normally cosmophiles average about 20, (o c to 30) of the white cell count. These cells rarely increase in number in infectious diseases or in those diseases terminating fatally It is in the non bacterial type of disease that an cosmo philia occurs Eosinophilia occurs following foreign protein injections and in conditions due to protein hypersensitiveness such as hay fever asthma angioneurotic occems It is also a characteristic blood cellular constituent in trichinosis and urticaria mycotic and various helminthological infections. According to Ebrlich and Lesares cosmophiles are formed in the bone marrow and from there are attracted to the blood and other tissues by the action of some toxin or other substance that is chemotactic for this cell Their clinical significance is still debatable. The proportion of council philes in the blood of children is greater than in that of adults Where the cosmophiles are increased to 5% we have a moderate cosmophilia. In some cases of infection with intestinal parasites especially hookworms hut also from other parasites as round and whip worms we may have an eosinophilia of 30 to 50%. In Guam among the natives it is difficult to find an eosinophile count under 15th. The eosinophilia tends to disappear when the ansemia becomes very severe. An increase of cosmophies always attracts attention to the possibility of intestinal para ite infections or to sky affections Losinophilia is common in onchocerciasis and frequently occurs in Los infections with Calabar swellings and in Dracunculus infection. The explanation of cosmophilia is obscure although Neisser regards the increased production of cosmophiles as an expression of sympathetic system tratation. The subject is discussed further in Lilariasis D 1178

Asthma -According to Huber and Loessler (1923) eo mophilia is the most striking cellular constituent in the atopic (inherited) forms of asthma In bacterial or infectious

types cosmophile cells were usually absent

Hoy Ferer - During the active symptoms of this condition cosmophiles may show an increase to 15" prior to the advent of symptoms of hay fever patients do not show an increase of cosmophiles in the blood Sternberg (1928) states that the shock of the sudden entrance of a large amount of pollen protein into the circulation is probably

the cause of the cosmophile increase

Helmenthological Infections-In the earlier stages of ancylostomiasis and schistosomiasis we have a rather notable increase to the percentage of cosmof hiles but with the advanced stages of these infections with severe anaemia the cosmophiles may even be absent. One should all ays keep in mind the very characteristic and marked cosmophilia of trichinosis when such a blood finding is encountered There is often a leucocytosis of 15 000 to 20 000 in this disease. In the urticatial fever stage of Japanese schistosomiasis the marked cosmophilia is of great assistance in diagnosis One trouble about attaching importance to cosmophilia in the tropics is the confusion which is difficult to eliminate and which arises from refections with the more common but less important group of intestinal parasites such as Ascariz and Trichuris and some of the filaridae Echinococcus infection has an cosmophilia which disappears when the

cyst is removed. Continuance of the cosmophilia indicates that all cysts were not gotten rid of

Myelogenous Leukaemia - Increase of both common hiles and mast cells is found in myelogenous leukaemia An compositia tends to appear following splenectomy. With a Wright stain

showing acid tendencies one may regard and count polymorphonuclears as cosmophiles unless noting smaller size of granules

Skin Affections -- Fezema and paonasis are not apt to give more than 3 or 400 cosmophiles. A rather high degree of cosmophilia is found in mycosis fungoid s Scabies also gives rise to an cosmorbiha

Trick noise -A combination of ecemophila with lever and marked rains in the muscles is characteristic of this crindition. This combination of symptoms would justify the excision of a piece of muscle for exam in tion for encyeted embryos

Typhoid -A normal or merens d percentage of cosmonlales is strong e idence against a diagnosis of typhoid

Eruptions,-The tropical fevers in which a more or fest diagnostic exanthem may be noted are. African trypanosomias a rat bite fever yaws dengue tsutsugamushi

spotted fever of the Rocky Mountains syphus fever and trench fever Eye Diagno tic Information Obtained from. Ancyle tomicasis - Retinal haemor thages may seeur with marked bookworm anaemia Stiles notes a fixed state in book

worm ca e the eventself a mewhat resembling tha aya of a fish. Among other diseases showing ocular manifestat one may be mentioned one associated with fibrous nodules in the upper hid due to lar at dibothrocephalid Sparganum man one

In pericorneal conjuncts it's the microbiarias of Onchoce co are usually found in a smp of the co junctiva

Ancurvem -- Inequality of pupil is a common finding through stimulation of sym

pathetic nerve supply to the corresponding pupil Are not Per oning -Pathness of lide a common finding

Bacillary Due lery -Oute a number of cases have been reported where alone with an arthrit c complicate n the e has been conjunctivities. In 6 cases of dysenterie contunctivitie Max ell noted that a cases had arthritis and a of the latter showed anterior uveitis. The consun tivitis is ted about a week. Relapses seem hable to occur In none of the cases has thir been secovered from the conjunctival ascretion the organism of dysentery

Ber be : - In the disease there have be ne ported the following eye complications (1) Retr bulbar neuritis (2) Paralyses of the muscles of the eye (3) Decreased sensibility of the co nea and consumets a

Bolulerns - Diplope and ocular pararytes are common on i ags

Cald act - The general impre son is il at cataract is more frequent in the tropical eg ons than 1 Europe and as bearing out this view Ell oft notes that cataract am ne those Europeans sho have seeved in India seems more frequent than among those who have remained in Fingland. Cataract is also more common in the southern part of China than in the northern no tion

Close 1 - 4s a result of the loss of body fluids the fachrymal accretion is a anty or absent and we have a no a conjunctival and corneal troubles unless the eye is frequently

i tigated with a smalls he I tree is opacities and externet may follow cholera Di it's - In diabetic come the s ft eya b II may be of great diagnostic aid and is r garded a a characteristic si n of the condition. Cataract is common and when

encountered before the age of fifty diabetes must be excluded Diphther s - Seuritis of the ocule motor nerve producing plosis or sq. at or more commonly p raises of cil ary muscle may follow d pl thena

f ephal its Letha g ca -Tran sent double vs son and paralysis of one of the ocular must so curs e peci lly at the onset of the disease and may be of only a few hours duration

Endoca d its 516 ule -- Petechial subconjunct val haemorrhages may suggest this

Ex pht Imic G ! - L tlag and hilsteral e ophthalmos are cardinal signs of this disease.

1634 APPENDEX

Fulancist —In that filarial infection caused by Los los at one time designated Fulans oculi there seems a special tendency for the adult worms to wander to be sold cutaneous tissues in the neighborhood of the eyes or under the palpherial or conjunctivate. When moving under the conjunctivate When moving under the conjunctivate the worms cause marked irruitation and at times pain. There may be considerable swellings on that the patient cannot for a time see out of the invaded eye. It has been stated that the worms may enter the anterior chamber of the eye but this is questionable. Lessons of the cornes and into many result from the migrations through the body of the microfilariae of Onelsowne columbia. Keratitis punctates and nittle base frequently been observed in Oceanicaes infections in Guatemala and Africa. For other heliumthic infections of the eye see p. 3379.

District Atthempts and Clare Conjunctivitis — These manifestations of tropical similarly vary in different individuals. From night discomfort after being exposed to bright vary in different individuals. From alght discomfort after being exposed to bright model of the control of the confidence of a discomfort of the control of the confidence of a discomfort of the confidence of a discomfort of the confidence of a discomfort of the confidence

Injectious Jaundice—Intense injection of the eyes may constitute the earliest and most striking leature. By some the injection of the conjunctives in regarded as almost anthogonomic pre-enting a distinct network of vessels in the corres and selections.

Lipray —The eye is more frequently avolved in nodular than In nerve legroys In the former we have inflictation of the conjunctiva which may extend to the consens. The legrous nodules invading the palpebral conjunctiva tend to ulcerate and bring about various distortions of the eyelds producing ectopous. Tries indocyclitis and and chorositis are less frequent than conjunctivits and keratitis. The optic nerve and tentina are only marely involved. In nerve legroys the eye changes are chaefy connected with the lessons of the fifth and facial ner es. Possis and paralytic ectopout occur with frequency. Ophthalmas and corneal ulcerations may lead to total descriptions may lead to total descriptions and paralytic ectopout the eye. The cornea may be anaesthetic. Paralysis of one or more ocular nucleis may cause squant or diplopus.

muscies may cause equium or opposite and the state of conjunctivity and keratus at Mainra—It is questionable with the form of conjunctivity and keratus at the property of the state of the state of the state of the opposite of the opposite of tracky a complication of malara. Retinal Issemorthages may occur in malaral cachena and cerebral types of permicous malara. Another sare malaral complication is and opposite of the state
lost for a time

Meningitis —Ocular paralysis may accompany other signs of this disease

Multiple Sciences: —Transient unilateral occular paralysis or transient bundnes may be an early sign of multiple sciences. This disease frequently simulates hystema Nystagmus infention trenor and scanning apeech are characteristic

Myxoedema -- Loss of the outer third of the eyebrow frequently occurs

Nephrits—Puffiness of eye hid is frequently as ociated with nephrits Defective vision is common in chronic nephrits and may be the first subjective symptom. The eye grounds in chronic nephrits are almost pathognomonic flame shaped haemortha es with white spots or radialing lines in the region of the macula.

Aight Blindness and Yerophil almse—Both of these conditions are quite common in certain parts of the tropics and the twee that the heat of the tropics and the tropics and sunlight were potent factors had precedence until our study of vitamin requirements.

showed the citology to cert in deficiency of fat soluble A. It is now known that codbrer oil is particularly rich in this writing and that to this agent we have one best prevent is and curative agent for these eye conditions. It is well known that ruis fed on a cit efficient in fat soluble do declop scrophishina. Night blunders (printlepoil, is best known among the creek of as long slope sepecially, when localized in trop cal waters and some control that have been as the control of the control of the strength of the control of the control of the control of the control of deficiences in water soluble B and the anisocrobitic viantum. In such a decisary fat soluble 8 would also probably be taking

Pappular Ferr -Inject on of conjunctiva is marked often in band formation extending across eye ball. Eye is tender to pressure and photophobia is severe

Same a .- This drug produces yellow vis on

Sidns In school of This find of may suggest obstructs no frommon dust sclerous of the let gall stones or mooms of the head of the pancreas catarnhal justodice acute yellow atrophy haemolyte jamodice permit us anatema social cell nanemax yellow force maintain black water feer. If of the size and possening by assenic phosphorus and carbon stratchloude

Syph 3—berven loss of cyclows suggests late secondary apphilas particularly if secondarion of streetile loss of hair or et temporal regions. Cornel ascarane may end not a previous apphilarle faittit. Inequality arrayularity of pupil and diamatebed on absent light refer should make one suspect syphilas. Distantial interstruits kertality indicater congenital apphilas. Dis pas pious or paralytics of any muscle of the eye suggests apphilas as the most of man cease.

Fick Free - In the relapsing I ver of South Mirica stritis has been in ted as occa-

sionally occurring

Tals series—In the ocul glandular type of the disease we have a primary localization in the conjunct is after There is weiging willing of the lids and occlume of the order conjunct is and possel format on on lower lid. Trackersess and pain in pre-abunduse parotid submanifiery or anteri c correctal lymph glands when present are most survestly.

T year towns to —Eye les ons are quite frequent in this disease those being kern this disease; those being kern this disease, the common that the type is not importante in diagrams. If y lesions have been reported as more common in Rhodenan trypanosimians. The atoxyl and trypanosimian the atoxyl and trypanosimian that disease many cause opinc neurities and blundoness.

I lims Ferr—In the period I cours a feature of the so-called I active of the clueses or a y be marked target in of the conjunct as with sensitiveness to 1 ht Rush Barnet in to the eye of a wild a small as contrasted with the less ferocomy ye of histon remittens 1 ver a stack me is resembled that I at a functioned and the or fourth day the arbest manifestation of jumnifice presents itself in the ocular conjunctura;

Face —Puffiness of the face with enlarged thyro d has sometim a been reported in acute types of American trypaneoumans. Such cases may be a been associated with endemue thyroid disease. O e ahould also consider glomerulo-nephritis and topycoordena with this symptom.

noyacedema with this symptom
Faces.—It is ad usable to examine a stool macroscopically before taking up the
microscopical eximination Pur or blood in stools may often be noted without the
aid of the microscope The normal stool is assume shaped and soft. In obstruction

and the common bile duct we has a schole, whitish foul-ameling stools. If the portry
toll be due to barteral change exposure to the air will restore the brownish tings:

Choir —The faceal charact r f the stool in cholera is soon tost and the typical
tice water stool takes its place. This designation is very apt and the floreing of inter-

tinal ep thelium in a watery slightly opaque flu d suggests nee water.

Dy entery — The muco-purulent atool 1 handlary dynestiery is flecked or streaked with blood or a very highly blood time d macus stather than the homogeneous grayish

brown gelatino a mixture o disintegrated blood and mucus of the amoebic stool.

The mucus of bacillary dysentry is paque and grayish from the great number of pus and phagocytic c lls. It is well to remember that Charcol Leyden crystals.

Filariasis —In that filarial infection caused by Leo leo at one time designate Filaria coult there seems a special tendency for the adult worms to wander to be substituted to the seems of the seems to wander to be substituted by the seems of the seems of the palporal of order conjunctivate. When moving under the conjunctiva the worms cause marked irrustors and at times pure. There may be considerable swelling so that the patient cancillation time see out of the invaded eye. It has been stated that the worms may enter the interior chamber of the cey but thus is questionable. Lessons of the comes and in many result from the migrations through the body of the microfilariae of Onderson columns. Neurality punctials and nints have frequently been observed in Occardiant infections in Gustemala and Africa. For other heliminthic infections of the eye see p. 1377.

These manifestations at most close Conjunctivity — These manifestations of tromes consider vary in different induviduals. Trom hight decomfort atter bong exposed to bright sanight the condition may grow worse until there is accert headache and pain and tenderness of the eyeballs. So hyperaesthete may these individuals become that even bright moonlight may cause disconflort. The jundens is normal but one though as em mand the suffering which an ophthalmoscopic examination may cause. The pupils should not be dilated. It is vise always to wear trated glasses when in the sun particularly it one eventures dissomitor. While there may be little incapatily at first the discomfort may after a few months or years of tropical readens become so marked as to necessitate one a fewing the tropics. No other faind of glass to do do the ill effects of glare equals the Crooke a glass. Cause of glare asthenopus other show and dust and make producing one conjunctivities. There is not in the teconice of the tear attending inward influence the frequency of proguentla and prerygum in the tropics.

Injectious Jaundice—Intense injection of the eyes may constitute the earlie Land most striking feature. By some the injection of the conjunctivae: regard das almost pathognomonic presenting a distinct network of vessels in the cornex and scientists.

Leproy — The eye as more frequently modved in nodular than in nere leproy in the former we have infiltration of the conjunctiva which may extend to the common the leprous nodules invading the palpebral conjunctiva tend to ulcerate and bring about various distortions of the eyelds producing ectropoin. This indioxylcities and behaviorable and extend the return at conjunctival transportation and conjunctival transportation and the return at conjunctival transportation and the return at conjunctival transportation and the return at conjunctival transportation of the fifth and facial nerver. Pross and paralytic ectropicoccup with frequency. Ophthalms and cornect ulcerations any lead to total descriptions and provide the provided of the eye. The cornea may be anaesthetic. Paralysis of one or more scalar murgles may cause scann to displays.

Meningitis - Ocular paralysis may accompany other signs of this disease

Multiple S lerosts — Transient unulateral occular paralysis or transient blindness may be an early sign of multiple selerosis. The disease frequently simulates bystems Nystagmus intention treme and scanning speech are characteristic

Mexoedems -Loss of the outer third of the eyebrow frequently occurs

Nephritis —Puffiness of eye lid is frequently associated with nephritis Defective vision is common in chronic nephritis and may be the first subjective symptom. The ever grounds in chronic nephritis are almost pathogenomous; time shaped bacmorrhages with white spots or radiating lines in the region of the nations.

Night Blindness and Verophthelma —Both of these conditions are quite common in certain parts of the tropics and the view that the heat of the tropics and the tropics analyst were potent factors had precedence until our study of vitamin requirements

Critics - Cases of cystics occurs ug in dysentery base been reported which showed amorbae in the sediment. I the urine Such cases prolably were connected with recto

esical fistulae caused by amoebic niceration

Federates -One of the manifestations of filarial diseas, as lymph acrotum in which the scrotum is covered with small blebs containing a chylous fluid which may possibly contain microf lariae It is associated with recurring attacks of lying hangitis There is also a filanal orchitis and we may be e a lymphangitis of the lymphatics of the cord Again flarial disease may show a ct plocele in which the turica vaginal's contains a fluid similar to that seen in the varices of lymph acrotum. This fluid may also show Glanal embryos

Fu cul its -In endemic funiculties there is a sudden onset with high temperature and pain in spermatic cord and ep didymis. The general cond to a rapidly becomes gra e with a hard tender cylin ir cal swelling along the cord and also pain and swelling of the epididymis. It is a streptococcus infects in usually engrafted on a filarial or bil harzal process and demands immediate surgical measures

Gong ene - Cases of gangren of the scrotum have been r ported as connected with malaria Gangrene of the acrotum and penis is not infrequently noted in Rocky

Mountain fever

Granuloma -- Granuloros f the pulenda is a disease which is common in many tropical countries and in the southern Unite I Stat a and in which organisms described as Donovan's bod es (perhaps related to Buc Hus mucous e p ulatu) m y be dem n strated to microscopical examination

Kela-e or may be accompanied by slough ng of the scrotum at the time manifests

tions of eancrum one are noted

Lepro y-1! leprosy comes on before puberty the sexual organs remain in an unde veloned condition. Leorous inflirations are a ted in the triticles and ovaries. In nerve leprosy which does n t usually c me on u til after puberty the women may bear healthy children and it is now ab ught that the view the lentoss markedly tends

to prod ee sterility is lack no in confirmation

Male is -In malaria Thayer at ted that nephr to occurred in about 200 of mal y nant tertian ca es MacFie Lambers (1040) lave called atte tion to the frequent occurrence of to a nephritis in se se quartan infections. Boyd a d I roske (1941) point out that malana infects in product a nephrosis rather than a nephritis

O ch i s - Maita or undulant fever may rarely be attended by an orch tis

Tichophylon Infect on - Dhob e sich is the actenstically located in the crotch

region Glands Enlarged -Ax II ry -The a m as drained by a chan of the axillary

lymphatics surrounding the anillary vessels. The a tenor chest to the morte is drained by a second axillary chan s tuate i long the lower border of the occtoralis major A third chain r erives the lymphatics dr int g the posterior chest axill ry lymph glatids m y becom enlarged d e to tularaemia tat b te fever plague syr hilis infected wounds Hodgki adiseas leukaemia glandular fever and malignancy Cerucal - The lower by the na d floor I mouth a edray ed by the submental fumbh

gl nds. The submanillary beneath the mandible so the submanillary triangle dra n th face lips nose and gums. The ear and anterior scalp are dr tied by the sup recusi cervical. The posterior reg on is drained by the superficial occ pital lymph slands The posterior auricular nodes situated a the masto d process are an import at group It is well to keep in mind both the superficial and the deep groups of cervical lymr hatics when a certaining the location of infection. The common causes of cervical lym phader opathy are t asilitis (gl ads below angle of jaw savolve i) tooth infection (gl. nds at ngle of jaw) sca let I v r measles t berculosis syphilis and glandular fever Th 1 to common causes are H dikins d sease and malignancy

Ingu not - The external genutals the fower part of the abd men and back tie but I the anus are dr med by the anguinal group of lymphatic gl nds lying about Poupart a ligament while the femoral group lying below the saphenous opening drain the leg. The inguin I group may become enlarged due to chancre chancroid and gonorrhoea. Tr p cal diseases ca sing erl rgement are bubon c plague filariasis cl matic bubo and sometimes talarsemia. In bubon c plague the femoral gl ads are

mo e frequently enta g d th n those sho e Poupart s byament

which are practically always absent from bacillary dysentery stools are not infrequent findings in the amochae-containing stools of course these crystals appear in other intestinal parasite infections

Sprue - The diarrhocal movements are remarkably copious and soon change from bile coloured liquid evacuations to the characteristic putty-colored pultaceous gas bubble permeated offensive stool of sprue. The sprue stool shows an increase in

fats chiefly fatty acids

Faget's Sign .- A falling pulse rate with constant temperature or a constant pulse

rate with a rising temperature. This sign is of value in diagnosis of yellow fever Fever -Probably the most reliable clinical sign of the existance of a pathological condition is a rise in body temperature above normal. The results of the introduction into the body of bacteria or bacterial thring are evidenced by fever. The relationship of fever to organismal invasion is best shown in malana where the fever corresponds to the different types of organisms present in the blood stream. Diagnostic data obtained from the study of the type of fever present are considered under temperature

Filariasis - See cosinnphilia glands and skin Diagnosis confirmed by finding

microfilariae in blood or by puncture of the lymphatic lesions

Gast.—The manner or style of walking may give valuable aid in the diagnosis of affections of the nervous system especially syphilis yawa diphtheria poliomychia Parkinson's disease and neuritis resulting from alcohol and other poisons. There are no gasts which can strictly speaking be regarded as peculiar to any tropical disease

Beribers -It is true that beribers patients show the steppage gait of multiple neuritis as owing to more or less foot-drop and lack of power to extend the toes the patient lifts his foot high from the ground to avoid scraping the toes and bends to the other side It is as if the man were walking through a mire Also striking is the manner in which a case of the paraplegic type of beribers uses a stick held by his bands to assist him in dragging along his atrophied and enfeebled legs. The legs are widely separated and the stick placed in front makes the twn legs and stick resemble a tripod. When other groups of muscles than the foot extensor ones become involved the gait is that of extreme weakness-a shuffing one

Dengue -We often note under dengue the designation dandyfied gait. This refers to the stilted mincing gast of a dandy and is probably the explanation of the derivation of the word dengue The pains about the site of the insertions of muscles with the slightest movement make these patients walk in a stiff self-conscious

Pellagra -In pellagra we may see a gast in which the patient separates his legs rather widely and uses a stick in front shuffling his feet along with knees slightly bent and soles of the feet scarcely raised from the ground Some cases show a typical spastic paralytic gait

Trypanosomsasss - In sleeping sickness there is often a shuffling gait which is very striking Sometimes it is as if one were dragging the feet along from pure muscular weakness

Genito urmary Organs -Symptoms referable to the genito unnary organs may vary greatly in nature from the pathognomomic lymph scrotum of filiariasis to an orchitis due to undulant fever In puzzhng febrile cases in the tropics one should always think of a possible pyclitis Renal tuberculosis should also be kept in mind

Ancylostomicsis - In hook worm disease menstruction is markedly interfered with and amenorrhoes is often a prominent symptom. Young men who have been affected before puberty show lack of development of puber hair along with infantile gental The girls do not show normal breast development

Billarmasts (Schistosomiasis) - The kidneys may be involved secondarily-the change being brought about by stone in the bladder and cystitis leading to hydronephrosis and pyclonephritis

Blackwater Feter - In blackwater fever there is usually marked pain in the region of the kidneys due to the plugg ng of the tuhules with haemoglobin casts Vesical tenesmus and pain along the preters may al n be present

Cholera -- In the disease the kidneys are markedly affected especially the epithelial hning of the tuhules though such changes are usually transitory (See p 613)

Terpanosemias s -One of the characteristics of the disease recognized as d agnostic more than 100 years ago is enlargement of the glands of the posterior cervical triangle (Winterbottom's sign) One of the most valuable of methods diagnostic of trypanosomiasis is by gland puncture the since obtained therefrom being exami ed in films for trypanosomes or inoculated into a monkey or guinea pig Brazilian trypanosomiasis also shows glandular in olvement

Tsutsugamush; - The glands which drain the area in which is located the ulcer at the

site of the bite of the Ledanz in te show awelling and tenderness

Tuls om a .- The anilary glands are most frequently involved due to the greater incidence of infections on the bands. The initial wound may or may not heal before systemic symptoms of discase occur but the in tail wound tends to suppurate at the onset of the systemic symptoms and this a diagn stic point of importance. There is often previous history of handling os cleaning rabbits. Initial lesion later fe er of sudden onset followed by a chill is characteristic

lact - In tang there may be glandular enlargeme t According to Finucane the cervical glands are often invol ed in Fiji children. These glands do not tend to break

down

Haematemesis.-The comiting of blood has to be differentiated from haemoptysis Having determ ned the the patient is vomiting blood the second step is to determine the cause. Common causes to be considered (1) Comiting of swall swed blood from (a) bleeding gums (b) et istazis () h emoj tysis (a) Diseases of the oesophagus (s) Diseases of the stomach (a) ulcer (b) ca e n ma () irritation from arsenic or ant mony (a) Diseases of the duodenom (a) Ice (b) carcinoma (c) ulcerations (c) diseases of the liver (curhos:) (b) Blood diseases (a) purpurs (b) seu vy (c) haemophilis (d) leukaemia (e) splenie naemia (f) malanal cachezia (e) syphilis (7) Arterial hyper tension and net hritis (8) To vical diseases (a) yellow fever (b) malaria (c) cholers (d) dengue (e) onvalue

Chel a-lamiting at first of the contents of the stomach and later of nice water material streaked with blood is a distress; g feature of cholera. The vomiting purping cramps and painful contractures. I the fees intense exhaustion and cada end appear ance are d agnostic features of holera

De gue-Rarely the initial symptom is the vom ting of blood streaked material u depaue

Mala to Carlerio - This condition may be accompanied by severe haematemesis

See malaria for diagnosis P llagra - Gastric disturbances especially gastralgia pyrosis and eruttations may

be accompanied by the vomiting of blood in pellagra

Syphilis - Visceral syphilis may be a cause of vomiting of blood. I llow Fire - Lauses and omiting are more common than in other fevers. The black yount is one of the most six king features of the disease. Sometimes nure blood is thrown up from the stomach

Haematuria. - The presence of blood in the urine calls for a careful examination of the genuto unnary system. Common causes of blood in the urine are renal tuber enlosis, bypertension stone in a dney hephritis tumor of the kidney and gonorthoea Among tropical diseases that which immediately auggests baematuria is vesical bil harz asia due to S hacmatobium. The blood in the urine is in the form of red cells it is a haematuna and not a ha morlobs una. The passage of b) od usually occurs at the end of micturation and it is either in the last few d one of unne or in the sediment obtas ed after centrifuging that we note the terminal spined eggs of 5 haematobium which proves the diagnosis.

Red blood cells in the urine may also be noted in the baemato-byluna of filanal disease

When we ha e bl od in the trine in yellow fever it is a baematuria and comes on about the same time as the black omit and other harmorrhages resulting f om degen eration of the endothelial I range of the blo d capillanes which only takes place about the third or fourth day of the disea e

Haematuna may also be noted in plugue at the time when the baemorrhages into the skin occur

Tropical diseases causing general lymphadenopathy are glanders tularemia filariasis undulant fever bubonic plague trypanosomiasis rat bite fever leprosy yaws and American leishmaniasis

American Leishmaniaris-Not only is there often enlargement of the lymphatic glands but likewise we may have lymphangitis lines leading from the ulcer to the glands The glands may be large and painful and may remain enlarged after the recovery of the patient

American and African Trypanosomiasis may also show lymphatic enlargement Enlargement of the thy roid was formerly reported but this is now regarded as an inde pendent condition

Climatic Bubo - The onset is gradual often accompanied by a low remittent type of The primary lesion is sometimes detectable on the prepuce or male genitalia The glands are only slightly tender and bave sometimes been called fatigue glands as they produce a feeling of weariness after even moderate exercise. The inguinal glands of one or both sides are the ones involved and the overlying skin does not show the redness of a chancroidal or gonorrhoeal bubo There is often a softening in the center of the affected glands

Dengue - It is often stated that the superficial cervical glands are enlarged in dengue but not in dengue like fevers. Stitt has not observed in the cases he has seen either

constant or well marked glandular enlargements

Filariasis -Varicose groin glands are frequently associated with lymph scrotum chylocele or chyluria The glandular masses are soft and doughy. The consistency is often that of a lipoma. The overlying skin slips over the glandular mass. These glands are sometimes mistaken for inguinal hernia They do not give a tympanitic note and disappear alowly upon firm pressure with the patient lying down but return even with the pressure maintained upon assuming the upright position. There is no impulon coughing If a sterile hypodermic needle be inserted into the mass a chylous fluid alowly and persistently comes out of the needle drop by drop and this material may show filarial embryos Onchecerco volvulus also obstructs the lymphatics and may give rise to swellings of considerable size along the course of the lymphatics

Leishmaniasis - Kala azar may or may not show enlargement of lymph glands Films from excised lymph glands may show leishmania hodies There may be general enlargement of the lymphatic glands which are rather hard discrete and not hound down to the overlying skin These glands may be somewhat tender or entirely painless

Legrosy -In leprosy the glands draining involved regions become enlarged but do not show a tendency to suppuration The glands most frequently involved are the

cervical and groin glands Pediculosis -- In pediculosis of the hairy scalp the scratching back of the neck may result in pus infection with enlargement of the tributary cervical glands

Plague -The huboes are the most characteristic feature of the more common form of plague bubonic plague There may also be slight enlargement and tenderness of the glands in septicaemic and pneumooic plague but many such cases fail to show any evidence of superficial glandular enlargement. In pestis minor the only feature sug gestive of plague is the glandular enlargement. Very characteristic of the glandular involvement in plague is the marked tenderness of such glands. The slight pressure of palpation causes some pain and a sharp punch over an affected gland excruciation pain So exquisitely painful are these buboes that the patient with groin or axillary buboes will flex the leg or extend the arm to reheve pressure In about 70% of cases the bubo 15 located in the groin with 150 to 20% for axillary involvement and 567 to 10% for the submaxillary or cervical region There may be involvement of both deep and superficial glands of a region such bubbes giving a large area of inducation. As a rule there is a single bubo The hubo is formed not only by the glands but by a periglandular oedema which fuses the glands into a solid mass. The bubbes tend to suppurate about the commencement of the second week so that gland puncture with subsequent culturing for plague bacilli and animal inoculation should be carried out before this time as progenic organisms may replace the plague bacilli upon suppuration taking place Rat Bute Fever -Glandular enlargement in the glands tributary to the healed infect

ing bite of the rat is characteristic of rat bite fever

Desgue - In dengue we may have an epistaris at the time of the crisis of the first fehrile naroxysm Dyse tery -Io dysentery the blood-admixed mucous stools are of diagnostic

importance Infectious Jan d ce - Epistatis is common Intestinal haemorrhage and haema turia may occur. The d agnosis is made by the finding of spirochaetes by dark field in a

blood or urine exami ation or by sumes me moculation Legrosy -- In leprosy epistanis may be an early sign

Malario - Epi taxis and alimentary tract haemorrhages are a common finding in

the recognized haemorrhagic form of pernicious malana Plat e - The damage to the endothelial lining of capillanes in plague gives rise to frequent haemorrhages into the skin

terr to -The granulomatous les ons of verruga are haemorrhagic in character

I ellow Ferr - During the authenic period of the disease which sets in about the fourth day we have as a result of the damage to the endothelial lining of the cay liaries various bacmorrhages. Of these the best known and most dreaded is that from the st mach black vomit. The bleeding fr in the gums is apt to appe r before that from the stomach. Not only may bleed; g occu from the intestines but from the mucosa of the nose consunctive or varies

Heart Involvement.-I, nder heart most ement have been included those trop cal diseases which affect the card ac muscle starif and those which cause a disturbance in the rate or shythm which may be of importance in diagnosis treatment or prognosis A cylo tomus a - Hook norm and mya may cause early and marked cardiac ipalpita

The pulse rate often a erages about too and the blood pressure is low

often some right side dilatation of the heart Beribers -Almost as emportant in diagnosis as the weakness of the legs with a aesthetic and oedematous areas is the early paloit tion of the heart upon the slightest exertion. I ater on as the agal degener tion becomes more promine t there is a loss f the normal card ac rhythm to even become embry ocar hal together with dilatat on of the right heart pulsati g jugul rs and various blowing murmurs which are propa gated into the vessels of the neck. The pulse is weak and rapid and this combinat on of a tumultuous h art action and weak pulse is striking. Blood pressure is below normal

In scute per 1 ous b ribers pulmo any concessio and o dema are often associated with the cute and a vere heart manifestations. The diaphragm may become para lyzed in benhen. Some auth is refe. to the dy photos f benhen as the herbene C riet

Card at a volvement is also a feature of ship benters a well as of infantile benters In the latter a marked hypertrophy of the right heart is characteristic

Eleckuater Fee -A rapid weak and low tens on pulse is the common finding in

hl ckwater fever

Choic a -I cholers the pulse is rapid and feeble during the stage of evacuation and with the o set of the algid stage we practically find cessation of the circulation The systolic pressu e may fall as low as 65 or 70 mm

Dys try-In bacillary dysentery the tendency to an increase in pulse rate may be of some all e in differentiating it from amorbic dysentery

Heat Stroke -C reliac tet my may simulate a gina pectoris. The pain is excruciat ing and may produc sudden death

Lep ory -A rapid pulse especially in the morning is thought to be a feature of active lep sy

Mal : - Malaria ge erally gives a small r p d high tension pulse in the cold st ge to b come t ll and bounds g in th hot at ge A card c type of pern co s malarial te er ha been described particularly by the French

Plagu -In the desease there is a striking tonic action on the heart muscle so that there is often a soft d crotic pulse rapid from the first and soon becoming thready Patients with plague may die from card c failure upon getting up from hed

Tryponoson losss - African tryponosoms are sh us a rapid pulse rate whether the patient has fever or not. In Bra alian trypanosomiasis the parasites may to dito invade the cells of the heart muscle thus p oducing manifestations of myocardial disease. The

Haemoglobinuma -The presence of haemoglobin in the unine occasionally occurs following extensive burns poison from anake venom administration of foreign sera or-most commonly-syphilis The vast majority of cases of true tropical haemoglobinuma however are due either to blackwater fever or to the administration of the acid saits of quinine to one predisposed to quinine haemoglobinuma. While it must be admitted that haemoglobinuma may result from quinine it i. certainly so rare in subtropical countries where great amounts of quinne are administered in treatment of malaria as to be unimportant. It is only where the malignant tertian parasite flourishes that we have the question of the importance of quinine in producin haemo globinuma brought up Certain persons have isohaemolysins in their blood which dissolve the red cells of other persons and in paroxysmal haemoglobinum autobaemoly sins may be present which can destroy the nations sown red cells. This autobacmoly sis seems operative only when a low temperature is followed by a high one When haemoglobinaemia exists the hver converts it into bile pigment causing bilious stools and jaundice. If one sixth of the red cells are destroyed haemoglobinum results.

Blackwater Feter -The dark porter-colored urine of blackwater is diagnostic even to the patient. The urinary sediment consists of granular dehma with occasional baematoidin crystals. Albuminuna runs parallel with the haemoglobinuna. Pain in the loins probably from the plugging of the renal tubules by the detnius of red cell destruction is a feature of blackwater fever. In blackwater fever we have the early appearance even in a few hours in a patient who is markedly asthenic and miserable

of jaundice porter-colored unne and albummuna

Paroxysmal Haemoglobinuria - Haemoglobinuria due to applicate intection This condition is characterized by haemoglobinaemia haemoglobinums fever enlargement of apleen and positive Wassermann (900") Chilling seems to be the essential factor for haemolysis in paroxysmal haemoglobinuma The haemolyin is peculiar in that it will combine with the cells only at a low temperature. It has been suggested that there must be some constitutional individual peculiarity necessary to hing about the condition as well as ayphalis. Taroxysmal haemoglobinuma of the nocturnal type is discussed on pp 140 and 1583

Haemoptysis - The spitting of blood is generally caused by disease of the lungs bronchs traches or larvax The determination of the source of the blood may at times he difficult. In haemoptysis the blood is generally frothy mixed with aputum alkaline in reaction and cough is present. The most common causes of haemoptysi are tubereu losis and mitral atenoma. However paragonimiasis must be considered especially in

endemic areas

Hirudinians - In Northern Africa as well as in many islands of the Orient the drinking water of ponds may contain leeches and these water leeches tend to atta h themselves to the pharvageal mucosa They may also attach themselves to the tissues about the laryax In these cases we not only have cough and haemoptysis but dysphoea from laryngeal oedema It is probable that cases of dyspnora called halzoun and due to the attachment in the region of the laryng of flukes (Fasciola hepatica) as the result of eating raw liver may sometimes be due to leeches as the two affections occur in the same regions

Paragonimiasis -Infection with Paragonimus ringers is popularly known as endenit haemoptysis for the reason that after violent exertion or at times without manifest reason attacks of haemoptysis come on The diagnosis is made by finding the opercu lated eggs in the sputum

Haemorrhage -The e cape of blood from the vessels may be evident by epistaxis

haematuria haemoptysis haematemesis or other sources

Ancyloslomiases - There is a question to what extent the hookworms abstract blood from the intestines although tests for occult blood are deemed important by some authorities in the diagnosis of this disease

Beriders - Some consider ship beribers may be of the nature of scurvy in which case one should have in mind spongy bleeding gums and the intramuscular haemorrhages of SCLIVY

Bilber 10315 -- In vesical and rectal bilbarzasis the perforation of the terminal branches of the portal vem by the terminal or lateral spined eggs frequently gives rise to

baemorrhages

ie er is often attended with a wearness from suffering with the various joint and perve pains so that insomnia is often marked. Even in trypanosomiasis insomnia may be present at first. Insomnia is also one of the early neurasthenic manifestations of pellagra

Intestinal Tract.-It is usual to consider constipation as a clinical feature of such diseases as plague yellow fever Malta fever benben and tsutsugamushi as well as typhus fever Abdominal pains are most often cooperted with dysenteric conditions and it is customary to state that the greater the tormina or intestinal griping the nearer is the dysenteric process to the carcum. In cholera the cramping of the abdom inal muscles may follow that of the calf muscles. In sorue we may have a doughy sensation on palpating the abdomen due to the fermenting contents of the intestine In the algid type of permissions malaria the abdominal griping may be severe. Tenesmus is the condit on which along with t rml a is encountered in some forms of dysentery In rectal schistosomiasis the thickenings a d blood extravasations resulting from the eggs extrud d by the fluke may give rise to prolapse of the rectum. This may also occur in severe bacillary dysentery and in a disease of British Guiana and Venezuela known as epidemic gangrenous rectitis prolapse and gangirne of the rectum may occur The sympt ms are those of gangrenous dysentery

Jaundice - The retention of serum b lirubin producing yellowish or greenish vellow discoloration of the skin is one of the most striking symptoms in clinical medione A skin p.gm ntation n t due to the accumulation of h hrubin is not faundice and other causes must be someht for a ch as Addison's disease diabetic bronzing and carot rems. This differentiation by the van den Berch test should be one of the first diagnostic steps t ken when considering mundice or skin pigmentations If it is found that the discoloration is d e to retention of serum bilirubin one may by the same test ascertain the type of jaundice present. I undice fr m a clinical stand point may be classified as (1) Obstructi e (2) Haemolytic (4) Tone and infective (Nichee)

In obstructive saundice the eact on realways immed ate and direct and in bacmolyt ic jaundice the re ction is a delayed direct one with a positive indirect reaction above normal. The toxic and infective type of raund ce orcupies an intermediate position but usually give g a direct reaction. The recovery of a large quantity of bile from

duodenal siphonage is in licat a of haemolytic saund ce

In obstructive saundice there is a den ite renal threshold and if the serum bilirubin reaches a higher concentration than a mg per too co of blood bilirubin appears in the unne. The kidneys are imper ous to the s rum hilieub a of baemolytic jaundice and no matter how high th concentration no blirth a appears in the urine but urobilin appears 1 stead. This e plates the acholic probilin leterus of pre van den Beigh days There may be a d ficiency of vitamin k

Haemolytic I undice -Serum bilirubin due to excessive red blood cell destruction may occur in (1) Malana (2) Bl ckwater fever (3) Pa oxysmal baemoglobinunc fever (4) Acquit d and hereditary baemolytic jatt dice (5) Pois ning by snake venom (6) I terus peonatorum (7) Transfusion with incompatible blood (8) Pei

nici saiaemia (9) Relap ng fever

Tox c nd infective 3 and ce is the most common type and occurs in () Toxic following chloroform arsen c and carbon tetrachloride poisoning (2) As a complication of acute infectious diseases such as yellow fever Wedla disease syphilis pneumonia

septicaemia and acute inflammation of the bile ducts

D ckens (Naval Medical School) we king with the bromsulohthale a test observed that in maligna cy of the h r the e was a relatively low dye retention the average being 27 307 at the end of 30 minutes This he explains by the fact that malignancy m y invol e only a portio of the liver tissue and stat trahepatic duct system leaving the remai der fie to exciete the dye. He believes that this would explain the seem i gly paradoxical d ect-smmedi te van de Bergh in auch cas s This author hel eves this finding is of ge at differe tial d agnostic value. The autopsy findings in the cases reported would seem to supp at this view. He also advises the siphonage of the duo denum I llowing the intra nous administration of the dye. If dye is recovered

parasite (Schizotryponum eru 1) may also affect the adreoals causing a low blood pressure along with other signs of Addison s disease

Typhus ferer is a disease which tends markedly to affect the heart. Along with

faint heart sounds there is a rapid low tension pulse

I ellow Ferer -In yellow fever we have at first a high blood pressure. The pulse rate which at first corresponds with the rise of temperature soon shows Faget a signa falling pulse with a constant temperature or a constant pulse with a rising temperature. It is a markedly slow pulse after the third day The blood pressure is low to the asthenic

Heat Effects of -Smith F T believes that heat stroke is a thermo-regulatory decompensation resulting from an imbalance of complex physical and physiological factors following exposure to heat Vasomotor collapse may occur with resultant prostration without hyperpyrexia or the attack may be sthenic in type with hyper pyrexia and grave prognosis unless prompt therapy is instituted. Tetany may occur in either type and involves cardiac and plain muscle as well as voluntary muscle Miners and fireman a cramps are manifestations of tetany of voluntary muscle Smith emphasizes the importance of tetany of the plain muscle of the intestine as a factor inhibiting water assimilation and the sudden death of aun stroke is attributed to cardiac tetany. The usual post mortem findings are generalized vascular congestion and petechial haemorrhages accelerated decomposition bacterial invasion parenchy matous degeneration and rigidly contracted left ventricle pylorus and colon. This spasticity does not persist long after death. Congestion oedema and haemorrhage effusion occur in the lungs and may be of extreme seventy. Exposure to heat is the primary etiological factor causing thermo regulatory failure Contributory factors include insufficient water intake associated incidental pathological processes and especially alcoholism Dehydration loss of chlorides and an uncompensated acidosis du to sceelerated metabolism and decreased respiratory exchange result Sudden death is attributed to tetany of the heart. Fatal cases that escape this hazard die from a variety of causes the cause in any particular case depending upon a generalized physiological disorganization and inherent weakness in the particular individual

Herpes Labralis -Small clusters of vesicles on the hip commonly called fever blisters are a common finding in malaria (40%) pneumonia (40%) and cerebrospinal fever

(30%)

Hookworm Disease -See agaemia

Hypertension -Arterial hypertension increases with age. The more common causes of hypertension are nephritis arteriosclerosis syphilis goiter toxizemia of pregnancy and the menopause Cerebral haemorrhage and tumor should be considered Hypoteosion -A low systolic blood pressure is common in cholera reaching a

low limit of 60-70 mm Hg Tuberculosis and e pecually Addison's disease also give

Indicanuria.-In sprue and pellagra we have a rather marked increa e in indican It is probable that many cases of vague manifestations of neurasthenia with loss of physical and mental energy are connected with automioxication rather than tropical

heat or intestinal parasites

Infectious Jaundice - Sudden onset with chill headache intense injection of the eyes vomiting and muscular pain Janodice occurs on 3rd or 4th day Fever falls by Rapid pulse and clouded consciousness help differentiate yellow fever and urine should be examined microscopically for Leptospira and guinea pigs should be inoculated with the patient s blood

Iosomnia - Sleeplessness or at any rate a condition where the nationt only dozes is often seen in dengue. This mental alertness and wakefulness may also be noted in vellow fever. In malaria possibly connected with quining administration we may have marked insomnia although cases have been reported of insomnia due to malana which has been relieved by quioine Just as cardiac decompensation from any cause will be attended by a distressing insomnia so is this also a feature of beribers where cardiac tovolvement is marked Liver abscess may be attended with insomnia Malta

It is Disease—Nuch interest was amousted in Wells of us e on epidemic jaundice on account of the frequency of the disease in wolders in the Blakin campaign and the outbreaks of it in central and parts of northern Furope and Fingland a dist occurrence in the Linted States. A spunchase was above by Bada and others to be the cause lines et some workers reported the serlain of paratryphond B organisms from the blood of such cares. Furopin oldstanted cultures of this organism from the disease in Leftopring interesteroid Rayle of the serlain of the serlain fluid of it is assess from a cases invest gaired. The accreted cruss of time Wells of case in Leftopring interesteroid Rayle of the gair deposits about the third day of an Information of the Control

appear until late about the third or fourth day. When paudoce appears carlier as by the second day the prognosis is almost surely a fastal one. The increus is more marked about the face neck and upper parts of the trunk. The albumbunian precedes the jound or. There are cases which success with that up, above is justed to the prognosis of the pr

fever cadaver is almost invariably deeply jound ced

Toint Involvement, Diagnostic Significance of — In con Identic the diagnostic significance of

cance of junct manifests now of temporal diseases at as essential dist the practitumer in the temps abear in it in the Commopolatea antibopathes. It should be rammbred that lessons of junts may accompany of follow almost all infectious can see and that it is often impose blue oscertain in the less was bed wet it actual preserved organisms within the joint or to the action of tore substances althorated claeshere so that indictious arthrinis as breadly deficie. J as no given the presence within the body of a focus of infection. This definition is further expanded to include joint affections of infection arthrinism and also those in which neither the causal organism nor its focus of origi is discoverable but which by analogy we of rhestiatingly recognize as being due to an infection again. It is not be noted that the known a farther may develop orbits in an infection again. It is not be noted that the known a farther may develop orbits in the presence of the control of

INFECTIOUS ARTERITES

A Of known etiology

May be at the orichronic Examples are gonorrhoen typloid tuberculous bacillary dysentery pneumonococcus infections pyogen excent filanasis. Visita fever secondary to any recognized focus.

B Of unknown etc logy

May be acute richronic. Framples are acute articular rheumatism rheumat id arthrists four types beginning with acute symptoms, some type having im rhouse meet and possibly hypertrophic arthrists. These several forms may be due to unitentified for often attracted in the amentary tract of may represent allergic phenomena second any to bacterial of other form of sens tration.

NONINFECTIOUS SETURITIES

A Traumatic

- 1 Acute due t koown traumatism
- 2 Chrone generally static nongra or due to throne statum or irritation Possibly includes illous arthrit s of the kne and hypertroplac arthrit s in the young B. Trophic

- rope

- Metabolic Examples are gout psonas s and possibly hypertroph c arthritis
 Senile
- 3 I curop thic Examples are tabes leprosy syringomyelia and acleroderma
 4 Arternoscierotic

from the duodenum by this procedure the common duct is patent. He believes this of considerable differential diagnostic value in distinguishing intrahepatic obstruction from extra hepatic obstruction of the bile passages

Arsenic Possoning - Jaundice is a characteristic symptom of acute or so called delayed arsenical poisoning. The appearance of this symptom is a contraindication

to the continuance of arsenical medication

Bilious Remittent Fener -The jaundice appears rather earlier than that of yellow fever but is rarely seen on the first day of the paroxysm as with blackwater fever Of great diagnostic value is the early appearance of bile-colored unne as different from the haemoglobin tinged urme of blacks after. The albuminous urine of yellow fever is not apt to show any bile coloring in the first three or four days of the disease

Flackuater Ferer - In a typical case of this disease me have within a few hours a marked jaundice which tends to deepen. It is usually more or less marked according as the haemoglobinum may be It does not show the tendency to persist as does the

saundice of yellow fever

The van den Beigh test is ni value in differential diagnosis. In blackwater fever it is delayed (indirect) indicating haemolytic jaundice. In approchaetal jaundice the van den Pergh gives an immediate teaction with marked increase in color by the indirect

reaction probably indicating infective januals e

Corbon Tetrochloride Poisoning - In poisoning following carbon tetrachloride jaun dice generally occurs on the second day following its administration. The jaundice may be a most striking symptom and again we may have toxicity without joundice Jamson Minot and Robbins state that jaundice may or may not be apparent but in their expenence the cause of the intoxication is best indicated by the van den Pergh Calcium chloride or ammonium chloride has a marked effect in controlling the symptoms

Corotinaemia - The presence of a carotinoid pigment in the blood gives a striking resemblance to rundice however the sclerae are not tinted. The definite recognition is by the van den Bergh test as in carotinaemia the bibrubin in the blood is normal. The icterus index will however measure the degree of carotinacima

Cirrhosis -In those liver circhoses associated with Katayama disease and kala arar

there is no typical jaundice

Hepatitis -- In tropical hepatitis or congestion of the liver or as it is often termed tropical liver there is rarely a distinct joundice and if such occurs it is only temporary Such terms as earthy muddy sallow aub scienc or pale lemon tint are more often applied than jaundice Liver obscess rarely gives rise to a definite jaundice unless the abscess be so situated as

to cause pressure on the bile ducts

Liver Fluke -- Ir clonorchiasis or the liver fluke disease of man jaundice is not a feature of the disease except in the very late stages

Malario -The jaundice in this disease is haemolytic in origin and the serum burub.

parallels the destruction of the red blood cells There is an increase in the serum b h rubin following each chill and this is of differential diagnostic importance See malana for laboratory diagnosis Permicious Angemia -The skin pigmentation so characteristic of this disease is

accompanied by biliruhinaemia. The diagnosis of pernicious anaemia is haidly tenable without a direct-delayed and indirect quantitative van den Bergh above normal See

pernicious anaemia for diagnosis

Relaying Fever - There is a chinical type of relipsing fever associated with jaundice and a high death rate which was first described by Griesinger from Egypt This ictens type is not infrequent in Asia. This jaundice is late and the disease much resembles The enlarged painful spicen and the finding of spirochaetes in the penph eral circulation are essential to differentiation

Suckle-cell Anoemio - Jaundice and snaemia are marked Ulcers on shin infantile sexual development and the finding of crescent shaped red blood cells are diagnostic

Spotted Fever of the Rocky Mountains - In severe cases of spotted fever of the Rocky Mountains we may have a generalized jaundice Rarely cases of typhus fever may show Janudice

hise course with modern and pannful swelling of various points hip shoulder ankle or conto vertibral articulations of occurring no are notemen era of Milas fever would at once make one suspect this disease. Typhood does not go e painful joints dengue is not accompanied by posits verified g while geometrolect polyaristics will be accompanied by other evidence of geometric an infection. The neuraliguas scatters and painful joints together with the aweata which chainst the sufferer from Milas fever often enopt both patient and physician to resent to narcotice. Regers found acute or subscutte efflue on into one or more joints was precised in at least 40% of cases of Milas fever. The Milas fever points and red which fact taken with its evanescent character deferentiates it from the architects of the contacts fever.

acter differentiates it from the arbitation of acute theumatic fever a market color and a formation of the color and a formation of the color and a formation of the color and a formation of the color and a formation of the color and a formation of the color and a formation of the color and a formation of the color and a formation of the color and a formation of the color and a formation of the color arbitation of proposation and the color and a formation of the color arbitation probability and a formation of the color arbitation of proposation and color frameword promotius. These color arbitations arbitation of the color arbitation and a formation of the color arbitation of the color arbitation and a formation of the color arbitation and a formation of the color and a formation of the color arbitation and a formation a

Kala azer -See le shmaniasis

Kerandel's Sign—Deep hyperaesthesia accompanied by pain often retailed after some slight hlow upon a bony projection of the body is characteristic of frypanosomasia

Lathrymal Obstruction.—Liliott notes the extreme frequency of this condition in India a distates that in the M dis Ophthalmic Hospital 3 operations for excision

India a d states that in the M d s Ophthali of o e or both jachrymal sacs were performed

Letthmanasta—Under this he ding four diseases my be grouped succertal leth manassis of diselfs or skale zi, infantile skale zi rectainensus lethicamassis or Omental toor and American I submanassis. Diagnos sof visceral he shimanassis () Disuble rate of temperature in it simpfour h period (s) Splenic calargement (s) Market letroperature (s) Market letroperature (s) Market letroperature (s) Market letroperature (s) Market nor splenic must be submanassis of the simple statement (s) Market nor splenic must be submanassis of the simple splenic manassis of the simple splenic market nor splenic must be submanassis of the simple splenic manassis of the simple splenic management of the simple splenic manassis of the simple splenic management of the simple splenic manassis of the simple splenic management of the simple splenic manassis of the simple splenic management of the simple splenic manassis of the simple splenic manassis of the simple splenic manassis of the simple splenic manass

On 11 So — This condu on must be differe tiated from syphilis The finding of Le thman a is d guo tic Oriental sore is often accompanied by lever The ulcer

is pinless

Legrosy —Legrosy is di sied into two will a parated din cal types (1) hodding of siah legrosy shahi is characterodd by grandbant is proliferation of comium and jumphatus glands. This form alones needlar insuffraction cheely about the cars now experiments and the extensor turker or let for name. (2) there of manched an aesthetic contraction of the contra

Leucoctosis —It is to an increase in the polymorph nucle is that this term is usually applied the term lymphocytosis or costinoph la being employed where white cells of lymphocyte or c nophile in the are more sed. We have physiological leucocytos in the fater necks of preg. or also i the new born and in conn ction with digestion. To agencie condition is an arranum diabetic coma and poisoning by CO tend to show a face y torus.

Bra Abse ss - The leucocytes rarely e ceed as ooo so by n abscess

Endo dit s — A m rked leucocytosis is of d agnostic importance in acute ulcerative endocarditis provid d it is not fulminant in type. In subscute e docarditis there is usi lly ly a mod at encrease in the number of leucocytes.

E y pelas - This condition is generally accompanied by a leucocytosis of from

2 000 10 30 000

1646

C Blood dyscrasias as barmophiba assaumas and scurvy

D Toxic as lead potsoning

The diseases of more peculiar importance for the tropics in which joint involvement must be considered in the diagnosis are the following

Bacillary Dysentery -As far back as the 17th century (Sydenham) it was noted that joint pains or actual arthritides were occasional complications of dysentery. He now know that the bacterial types of dysentery are those most likely to show joint complica tions Because the joint fluid in these lesions is usually stenle it is assumed that they are the effect of towns (or a toxin) produced by the dysentery bacillus. Of the two hypothetical toxins of the dysentery bacillus one is supposed to produce neutits and joint complications. Arthritides are more common so some epidemics than in others and with certain strains of bacille than with others. The Shiga strain is the worst offender in this regard. Manson reported 27% of joint involvement in one enstenic

Clinically dysenteric arithritis is more apt to affect one of the larger joints the knee ankle and hip being most affe ted. The elbow wrist or shoulder joint may be affected though this is unusual. The pain and snelling may be an incident of the early part of the attack. Usually it comes on when the acute symptoms are abating or as a sequel. The joint is distended with effusion and this involves the hysments around the joint. Civen an arthritis in the course of a frank dysentery there is nothing it could ordinarily be confused with. It is well to remember however that patients with dysentery may have also a concurrent gonorrhoes or arthritis from some focal infection. The dysenteric rheumatism ordinarily completely subsides with the cure of the colitis. In hepatic abecess following amorbic colitis pain of some type is a frequent symptom Rheumatic tike pains and swelling of the hunds occur rarely rapidly disappearing when the abscess is evacuated

Dengue --- Sporadic dengue is difficult to disgnose. In an epidemic the characteristic main referable to tendinous insertions about joints are present in at least so" of cases and is of great diagnostic value. There is no anelling of the joints although the fur gescence of the 1km over them may give the impression of an arthritis. The intensity of pain varies from a feeling of muscular soreness to excruciating pain when muscles or joints are actively moved. Passive movement is not usually painful. In addition to the rachialgia bone and joint pains some writers have described swelling of the joints This last in State a experience is unusual Joint pains are so characteristic that they du tinguish dengue from all other eruptive fevers

Joint pains during consulescence may produce stillness and empling continuing

for many necks after the cessation of fever

Filteriaiss - Mariland and Manson Babr have noted a synovitis which is apparently a complication of filanasis. The latter has found a fibrotic ankylosis often to follow such a joint condition. The synovitis may be followed by pus formation with serious or fatal outcome

Guines Harm Disease - Rately the female Dracunculus may penetrate a joint

and cause avnovitis or arthritis

Leprosy -Occasionally there is joint involvement especially of the wrist and ankle joints in a buch erosion of the cartifage and bone dislocation occur giving us a condition similar to the Charcot joint. It will be remembered that the Charcot joint is most often seen in tubes and may give one of the greatest joint swellings. As a rule only one ment usually knee or hop to survolved on takes and the affection is generally punites. The progress may be acute subscute or chronic Synagomyelia a disease which may be confused with leprosy may at a show joint involvement usually of the upper extremity

Relopsing Ferer - Bone muscle and joint pains are practically always present in this disease. In addition rachialgia and headache are provinent symptoms and the aching graning pains in long or nape of neck may make one think of beginning small por dengue or sellow fever There is no swelling of the joints in relapsing fever As in dengue the pains in the neighborhood of the joints may be quite persistent

Undulent Feret -This selection offers a good example of a disease in which joint symptomatology is of diagnostic and therapeutic importance. A prolonged typhoid

Me die — A leucopena with a comoid nt masked increase in the lymphocytes is characteristic of invasiles and occurs se eral days before the Kopiks spots appear. The leucopenas and lymphocyte incre se an measies are important points in differentiating it from earlisting.

Papalatas Fere — Leucopenas of 1000 to 2000 feucovites is often overent from the

onset of fever and extends well into convalencence

Permition a Ana ma - The aplastic type shows a marked leucoperia

Po so the by Alcohol and Arsen c - Chronic alcoholism and chronic arsenic poisoning

cause a re luction in the number of the whit cells

Typhod — The le cojenia of tyj hoid is mider to and i often preceded in the first
few days by a moderate neutrophile leue cytosis. Later on we have a decided increase
in the lymphocytes. A marked diminuit on or absence of cosmophiles is so characteristic.

in the tymphocytes A market diminut on or ansence of cosmophics is no characteristic that any increase in cosmoph to perce tage negatives a disposal of typh of Para typhod gives a similar blood picture.

A ray it aim sit in its to destroy beucocytes in the extoacd region especially poly

\ ray tr alm mt t nds to destroy leucocytes in the exposed region especially polymorphony clears The amali lymph cytes rel ast affected

Liver Enlargement of —It is well fru to out no the uper edge of liver dullness by portions on it is reacher much also or the 5th might retrained as the water part on the dullness when the right and analysis in it may be said to be enlarged upward. The us an import it dig mostic por the because the up and stresson of the redullness units and generally near the raberess had ted cyst or a subdisp's regentic absences. The liver benefits of the first may be suited and generally near the raberess. But did cyst or a subdisp's regentic absences. The liver benefit of the first may be to grant the benefit as firm most to togath the suited of the liver and the liver and the liver and the liver and the liver and a failure traduction and the liver are card as failure traductions and our bill the liver are card as failure traductions.

In the trongs one should keep ro mand m ad it son to the above (i) Abuses of the liver (more commonly found in the right bobe) (i) Tropcalls it (i) Malain, i), Relapsing I freer (i) Asia stat (ii) Weils die se (j) Trypanasomiane (ii) Melig ancy of the liver (of uncommon). The descrement causes et sep in seame man H spine disease arrane posoning carb n tett chi nie po toning leuka mi tholong this amyford disease their view of faithy whithin a mid descreated on

Asia a a — In kais axar the h er does not begin to eni rize until after about three months from the cime i nosed as hack time the piern will be quite large. Decided materiatement a generally octed by the such month. Is all azar patients are often carried off by a terminal pneumons probally connected with the leucopenia and marked dignustion of polymorphomoul ars.

Inter Abr. 1: —In liver abscess the enlargement is a 3 ther late feature a d the continue abould be d agon ed before we have the as 11d ee of p otruding mb and distension of the meter cotal appaces. As the abscess a usually located in the upp r portion of th. right lobe the enl regement is u ually of wards a d is best made out with the X ray, how now, the cupoks hake projects in ...

Sypl is —In the t opics one may t always keep in mind the possibility of a liver enlargement being d e to syphilis

Topical Liver — There is only a slight enlargement in the ord nary case of tropical her but in some cases it may extend 3 or 4 fingers breadth b low the costal eart lages or rely to the umbit on.

Liver Pain in .- The most common cause of pair ful liver is cardiac failure

Lunacy in the Tropics - van Lo having examined over so cases from among 1100 insa e p tents in J va found the most common types of mr tal di case to be

Liver Abscess - Rogers reported that in liver abacess with a leucocytosis of 15 coots 20 000 we nave only about 5 to 77% of polymorphonuclears-there being also a moderate increase in the percentage of large mononuclears

Malignancy - The blood of ca es with malignant tumors t nds to show a moderate leucacytosis except in epithelioma of the skin. When a cancer is ulcerating quite a

high white count may be obtained

Afeningifus -With meningitis counts of 25 000 are not unusual. Epidemic cerebrospinal meningitis also gives a leucocy tosis of from 15 000 to 20 000

Flague -We usually have a marked leucocyto is due to a great increase in the poly morphonuclears The white count may exceed 50 000 Just as septicaemic plague may so overwhelm the organism that st does not respond with fever so may the leu cocytosis be absent. Bubonic and pneumonic planue tend to become equiaemic so that in such types of the disease we may often obtain a definite diagnosis from blood cultures while in bubonic plague a microscopical preparation or culture from the bubois usually diagnostic

Preumonia, Lobar -In this disease we have a less ocytosis of a coo to jo coo or higher. The ensimphiles are almost absent. A normal leucocyte count makes the prognosia unfavorable

The leucocyte count drops about the time of the cris s and with the reappearance

of easinophiles is a favorable sign.

Relapsing Freet - Spito hacte fevers as relapsing fever may give a l'ucocyte a of from 25 000 to 50 000 when accompanied by high fever and bronchitis. The average count gives a leuco ylosis of from 12 to 14 thousand with a polymorphomiclear increase to between 75 and 80% The normal percentage of large mononuclears helps in the differentiation of malaria The leucocyte count tends to be higher about the time of crisis. The diseases most likely to be confused with relapsing fever are malana dengue and yellow fever. The tinding of the malanal parasites or spirochaetes will differentiate these diseases. The leucocyte count is higher in relapsing fever and in malaria the afebrile period is shorter. There is a leucopenia in dengue. There is no leurocytosis in yellow fever while malana and especially dengue generally show a

legcopenia Septio Prace ses -The lepcocyte count is of great value especially when we obtain a leucocytosis with 80 to 900 of polymorphonuclears as in append citis cholecystitis of

other suppurative conditions

Smallpox -Smallpox especially at time of pustulation usually gives a leucocytosis of from 12 000 to 15 000 Smallpox often shows a very large percentage of very

characteristic large mononuclears

Leucopenia.-This is a term used to designate a reduction in the normal number of leucocytes A leucocyte count of 5200 would represent a slight leucopenia one of 2000 a marked leucoperta. In the later stages of typhoid and in acute miliary tuber culosis we expect a moderate leucopenia. Glandular tuberculosis may give a very marked leucopema Tuberculous perstonates will show moderate leucopems or a normal count. Agrarulocytic angina al o gives use to marked leucopema primarily of the eranulocytes

Dengue -In this disease a leptopenia which begins to show itself by the second day is very characteristic. The average leucocyte count is about 2500 and along with this we have a reduction in the percentage of polymorphonuclears to about 50% Towards the end of the terminal fever we have an increase in the percentage of larg

monoguclears

Exophthalmic Goiler - Aocher n tes that in exophthalmic goiler the leucocyte count is considerably diminished and that the polymorphonuclears are not much more than one half the usual percentage while the percentage of the lymphocytes is almost double the normal

Infuer a -- Influenza shows a leucopema The very fatal pneumonias of the 1918

enidemic of influenza should a marked leucopenia

Ada-o or -In this disease there is a marked leutopenia . Kala azar must be par ucularly differentiated from Banti s disease malaria and undulant fever

Molaria - During the apprexed period of majaria we may have a white count of 5000

Melaniferous Leucocytes.—These are usually large mononuclears bearing partials of important macrophages which have negested malarial pagment and are characteristic of malaria and blackwater fever.

of malara and blackwater fever. Methodosca. The description of malara and blackwater fever. Methodosca. The description considered as a very virulent type of glanders and in those cases which do not de on the pest 2 or 3 days the pustules and subcutecous abscures may suggested the ordinary glanders or pustules appliables. Involvement of bone takes place if the patient have beyond the second or third week next of bone takes place if the patient have beyond the second or third week next produced to the patient have beyond the second or third week next produced to the patient have been described by the patient of the second or third week next place to the patient of the patient of the second or third week next place to the patient of

aggiunation for Bit it was whiteness. Death occurs almost invariably. Memorrhagia and Mettorrhagia—takher of the conditions may occur when women first arrive in the tropics. Their exact relationship to change of climate is not known. Should mettorrhagia persent and produce constitutional symptoms or the ana man become grave the woman the slid terminate her residence in the tropics. Refere these conditions may be said to be due to the change of climate all before causes such as condensetriat subarvolution displacement. I the uterus lace attents tumors owarian climata and also also should be excluded. After the rate of it, winternancy should be

excluded in all cases

Mononneleosis Acute -See p 1050

Mouth Diagnosic Signa Chiamed Iron.—In considering sore mouth one should also keep in mind the diagnosic colors of the breath such as in also hism and varenia Common causes of sore mouth a c stomatist a syphilis postnike torsullitia and thrush. The onset of permic ous anaema may be accompanied by a firsty the actentic red raw tongee and quint.

Here a Lab altria not so common in trop cal malarias as in the cof temperate climates

It is absent in plague preumonis

Leukman an -In kala azar and poss bly in malaria we may have gangrenous

conditions of the cheek as cancrum ons

Legrey — In let pay the nodules who to form on the node of the checks and fauces tend to show ulceration and thickenings. The discharges from the ulceration in the mose especially those on the since reach the pharyon and such leproxy bacillicontaining discharges may be espectorated and cause one to consider the material as coming from the lains.

O yels—A very peculiar do set of Portuguese Next Alnea and also the Souther Region Annua is nyal 1 is characterized by the appearance of blood-distended venicles of the micross of the che is and heart patitive. The torque is often sweller the thin may show harmorh get and hearistics is not inferquent. The mouth blobs ary in size from that of a split pet to a disneter of \$\frac{1}{2}\$ is not more. The cause is unknown. In severe cases there is assensial and an ired districts in the blood platelets. The blood may show a normal complation time but there is usually a prolongation of the blooding time. To onest is sudden and the mortality of

Pollary — In pellary, there is most fixing, at the angles of the most b with a large andeated tangue with central cauting and have tap and sides. There is often a glary muous covering these red bonders on the side. The fungiform papilise are p manest. Lastro on the tongue as y be owned is need and undo may yet. The buccal muocous shows a carmane flush. The games are tend to but there is not the tend eavy to aphthous ult on one sees me some. The flow of salves as frozently uncreased.

Sp ne —In spine there is at first great eens tweness if the boxcal mucoss so that articles of moderate pungency pi e use to painful burning sensati in. The tongue becomes quite sore with easele formation long borders and tip which soon turn into ulcers. Ulceration may also occur on the buccal mucoss particularly at the site of the posters ruppers and lower moliar it eth (Crombi es ulcer).

The congestion causes a great increase in mucus especially about the faucial pillars and pharynx. Ulcers are common about the feature of the tongue. While the tongue is coated at first with red ulcerated tip and sees it later becomes bare of any coating red and finally even glared as though warmshed. It is at times fissured.

dementia practor, general paresse various manifestations of cerebral syphils and acute manifestal or confusional states. Not only were all forms of mental disorder known in European countries represented but their comparative frequency and the types of conduct exhibited were on the abole what might be expected in the study of a group of smiler cause reconstreed up my other part of the world.

Overbeck Viright in his book— Lunsey in India —notes that 44° of cases wert under treatment for various types of manua 150° for metanchola 48° for elemental instantly 51° for drie, 57° for deementa and 60° for instantly following the set of Connobus indice. It is noted that dementas pracors is not included in the statistical returns but the author states that in his expensione the high rings and fastions actions.

for a much larger proportion of cases than melancholia

Overbeck Wright is of the opinion that general parens is quite common in ladia notwithstanding the fact that for many jears the opinion has obsimed that yield of the central nervous system and the parasyphilities diseases were excredingly and among tropical natives. He regards the anothere of excepted disease in synthet natives as less than with I uropeans attributing this fact to the ensistence of an insimitry acquired through the prevalence of synthius among these people during a period of several centuries. Cases of general parens are generally reported under the diagnosis of throne many.

Lymphocy tous — loung children have normally an excessive proportion of lymphocytes even to, a reversal of the polymorphomycles lymphocyte relation of subto This is spt to be particularly marked in hereditary syphilis balared tomain may gue use to lymphocytess of a ooo do to 15 000 when more than good that white cells may be lymphocytes. Rickets and secury also cause a lymphocytoms of course the durase in which there is the most marked lymphocytosus is lymphate feedersmin.

Glandular ferer (Pfeifler 1889) (inf ctious mononucleosis) is a mild acute febrile disease the fever coming on after a short incubation period and lasting from une to several weeks. Throat infections particularly bucent a spiritions have been thought by some to be concerned in its genesis. Choically it is characterized usually by sore throat swelling of the cervical glands and general glandular enlargement of variable degree and often enlargement of the spicen | Lecovery practically six ays occurs within a few neeks. The total leucocyte count is usually from 10 000 to 12 000 with a lymphocytosis of from 30-9067 In some cases there is a normal total count of there may be a leucopenia. The lymphocytosis may not reach its peak until after one or two weeks The characteristic feature of the blood is the larger number of pathological lymphocytes present Paul and fluenell (1932) found that the serum in most cases after y-10 days showed an ancrease in aggintimus of sheep red blood cells Basley and Raffel (1935) have found that this is unlike heterophile agglutanins being absorbed by autoclaved on cells but not by suspension of guinea pig kidney. A positive reaction is indicated by the disappearance of agglutima in the scrum extracted with autoclaved or cells and by its persistence in that extracted with guinea pig kidney

Undulant Feer - Malta fever is a disease which may show quite a lymphocyte increase this in association with a reduction in the polymorphomiclears

If looping cough may cause a lymphacytosis of 20 000 to 30 000

Malaria — Characteristics of this disease are (i) Presence of malainal parasits in blood (c) Peroducity of child and fever (3) Spleme enlargement (d) Response to quantic (5) Presence of melantierous hencoytes (d) Increase in monopolicis leucoytes when a leucopenia is present

man may sometimes serve as the intermediate host through the accidental sell infect on with the eggs of T or is m. buch infection may resent diether from contamnated hands or by ripe proglottids being carried back to the atomach by reverse peristaliss. The combros them may magrate to a limited any urgan repeatably the muches and in many, instances the train with symptoms of epideny. The common tages worm of manimations there is no ever a cyticitical stage in the muscles.

Mycoses.—The best known negones of the trop ca are the following (a) Mycetoma a bicase caused by various four javading most commonly the four which is hongy or mbed by numerous granuf matous areas from which is down matterious distribution to lade, granules, and eventually lated to down matterious of bone and other yellow or lade, granules, and eventually lated to down matterious to bone and other granules and eventually lated to down matterious (a). These cruss the well-known disbust said of the Ornest in which mayorem lake affects not the create, the stehn is accessive (a). Piedra which is due to a fungus aff thing the hairs especially of the bead and having grity poddles along the causes of the hair (a). That is a ware only coloured than affection was formerly the cause of the hair (b). The colours have been discussed in the colour of the cause of

Mysases. —I'll ese are dis ases caused by the invasion of arious fly larvae and may be divided especially into cutaneous mysasis untestinal mysasis and mass! mysasis

Culd cour Myidra .- In tropical Ame ica boil like ferions may occur from the de clopment of the larva of a spece as of bothy in any skin area unprotected by clothing In Africa there is a unular type of lesion caused by the larvae of another fly (Dermo-lobia and Cordylob a)

Intertinal Mysas: - Yague intestinal disturbances or solent abd iminal pains may be cau d by the presence of the la vae fivanous fly species in the intestinal tract. The infestation may be accompanied by fever and other symptoms. It is probable that the eggs of the flues gain access to the alimentary tract by being deposited on the

food
Nasal Jiwas s.—In the tropical and subtropical parts of North and South America a
by Ch y compa macell ... as part to deposit as gas about the mail orifices of persons
with an officency exchange from the most. The by seems to be attracted by foul dors.
The larvae which develop are called see we worms on account of the segmental
backs of b the sand tend to awards the worms and account of the segmental
backs of b the sand tend to awards the worms are causing great destruction of

The case sets in with signs of a very selectoryzal together with fever and marked frontal headsche. The face become a swohen red and tender in the region of the mose. As the larvae reach maturity they come unt of the nose. A missal douche of 5 parts of hordorn in too parts malk is oft o effications in bindning away the lar selections.

At tim a Socraphoga is no my be find. See p 512 for other forms of mysass.

Nauses and Vomung — So many di ses are attended with ausea, hes des those in
which nausea is accompanied by rather constant omiting that it would hardly seem
advisable to c naid rit at no 44 the same time the slight was ea which then accom-

pames bacillary dyscatery as o of the manufestation f to a many suggest this type of day netry rath r than the amoebus one

Ber ber — tomating is often a sign of dangerous wag i involvement in acute permits to the control of the co

cous beriber. Some consider that the e tr me dilatation of the right leart pressing on the stomach, may be the excitant of this vomiting

B : ur Rem il ni Fere --Bili us omiti g is the feature in bil our remittent fever which causes the pat ent the greatest distress

Blacku le Fer —In blackwater fever the frequ ut retch ng and bili us vomiting tend to exhaust the pat ent and the perastent v miting of green bile often prec des death.

Choi rs —The vomiting of h lera follows the diarrh ex. The material omited may be of the same char eter as the rice w ter stools

Liv Absects -Rarely a liver absc so may burst into the atomach in which case there is usually vomiting of pus. Of ce ise the more common route of rupture is by

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Typhus Ferer -In typhus fever the mouth is frequently strikingly foul with marked sordes covering the teeth The dry brown tongue in this disease is sometimes known as the parrot tongue

I erruga -In the miliary type of verruga we may have the granulomatous knows

appearing on the mucous membranes of the month I ellow Ferer -In yellow fever the bleeding from the gums usually precedes the

black comit

Muscle Involvement, Imorbiasss -There have been reported very tarely dis integrating lesions of muscles and cutaneous tissues in which amorbor have been found Beribers -In this disease we have muscular atrophies especially of the muscles

innervated by the peroneal and plast nerves similar to those following other forms of perioheral neuritis

Filariasis -Filarial abscesses have been reported in the tho psoas muscles in a few Wese and Minett found evidences of adult filanal worms (il bancrofis) in 22 out of 28 deep-seated abscesses which were examined by them. Many other investi gators have reported filarial abscesses

Heat Cramps .- In those norking in frecooms or steel mills the excessive heat to which they are subjected may cause various manifestations of heat prostration among which painful muscle cramps are prominent. These cramps are somewhat similar to those which are such a feature of Assatic cholera and in each instance are supposed to

be especially the result of dehydration of muscle to sue

Leprosy -- In this ancient disease the course of which is marked by smiesthesia atrophy absorption and accidents (eigerette burns etc.) the lesions of bones joints mustles and indeed of all other tissues are in creat part due to infiltration of neries by the organism of leprosy. The effects are secondary and trophic on the one hand and on the other partly due to secondary infection of the legroms by carous bacterial agents

In nerve leproxy there is often atrophy of the small muscles of the hand and of the muscles of the forearm The contracture which tales place under these circumstances gives rise to the claw hand. In tubercular and mused forms of leprosy there may be in addition trophic disturbances of the fingers and toes and also extraneous infections which may ultimately result to amputation of fugers or toes. This process going on over a considerable time or being repeated results often in stumping of fingers

bands toes or feet

In addition to these openly destructive processes there is often seen in leproty a condition of subcutaneous absorption of all the tissues. In this pay the distorted anger nail may come to occupy a seat over the knuckle or even (though rarely) further up the back of the hand or arm Briefly in leprosy we have as representing the path ology muscular atrophy from nerve involvement percestits and arthrits interstital absorption of bone and contractures resulting in mutalation of fingers toes hands

and feet from trophic disturbance and intercurrent bacterial infection

Myositis Pu wients Tropica -There may be a suppurative myositis with a single abscess formation or with disseminated foci or a diffuse purulent infiltration. The attending fever and toxacmia are similar to those attending any deep abscess formation Abscess formation in the muscles has been reported from various parts of the tropics especially the Gold Coast. It is possible that the condition may occur sometimes in association with ill bancrofit infections. However either staphylococci or streptococci. have usually been cultivated Pauzo regards the condition as a secondary streptococcal or staphylococcal infection in blama infected subjects. Grace and Grace in the study of 300 cases in St. Litts with a death rate of root found the cause to be a haemolytic streptococcus which was also present in the throats of those attacked. The condition has been more commonly found in debilitated sufferers with long standing infections

Trickinosis -Acute muscle pam is a feature of the stage of muscle penetration by the larvel Trichinella spiral s The fever is often suggestive of typhoid fever with ordema about the face. A marked cosmophiba is characteristic. Another belimining parasite which may rarely invade the muscles of man is the larval Taema solium giving rise to cysticercosis Taenia sal um infection in man which is rare depends usually moon the ingestion of the cysticercus or bladder worm stage by cating pork However legs pain on pressure in the dorsal region of the back and confused mental state suggest the diagnosis of pellagra

Syphilis -- In syphilis th re is slow onset midely distributed neutric pains and history of initial leaton Positive Kahn blood serum reaction is usually present

Undulant Feret -Very characteristic are the sudden and painful joint swellings accompanied by various neuralinas, such as sacro iliac pain and sciatica

DISEASES WITH SYMPTOMS WITHOUT MAY BE CONFUSED WITH I PLRITIS

Trichinosis may be confused with neuritis. This condition gives rise to pain and tender ess in the muscles which do not follow the nerve distribution Foundphila history of eating raw meat oedema of the lids and muscle pa n should help to dif ferentiate. The finding of T spiralis i ports us all e cised muscle is d agnostic. In rat b te fever there is pain in the legs without p ralysis or disturba ce of reflexes or neuritis Dengue Malta fever and yell w fever produce acute general pain in the limbs but not neuritis

Nodules -- Small raised a dules appearing on the e r cyclrow cheek or chin should make one suspicious of leprosy. Le shmani in dules are mail pink sh elevations seen in the non ulcerative kelo d type of oriental sore. Cuta cous nodules or tumors are the most striking clinical feature of onchoe cia 5 Juxta articular no jules are 5 m times found in associat on with onchocerciasis and also in y ws D fferential diagnosis

may be made by punctu e and demonstration of mic oblariae

Ordema .- Oedema may be erroum cribed or local or may be general. The chief causes of general ordema are-heart failure renal usuffic ency angioneurosia ancylos tomi sis idiosyncrasy to certain drugs such as potassium iodide and asp rin and snake bite It is us fly not difficult a scertain the cau e of a generalized ordema. The orderns due to heart failure affects particul rly the dependent parts of the body. If the patient is up a d about it is I und th t the I we ext em ties become oedernatous while if the nations is a bed the lower some area becomes codematous. The orderna of nephrit s is ge emized and shows no predilection for the derendent parts

Abace see cellulate and external o superficial tumors croduce i ral oedema. In eryspelas there is swelling and tensi n of the sk n w th an advancing ridge rai ed and well defi ed. There is usually nedema and bulging over the mastoid in acute : feetions of this region. Empyonia not infrequently is ecompanied by ordems and n saive congestion. Aneury sm of the ar h of the aorta may prod ce cdema of one arm or of one side of the face as result of or sur on the adjacent ein. In angioneur tic ordema there may be local dedemat us swelling of sudden and t ansent duration. Tumors intol ing the mediastinum may sh w unilateral or bilateral oedema together with tortuos ty of the supe ficial veins of the face neck arm or chest wall. Permenhric abscess may show ordem; o puffiness over the lon Tr chi sis is frequently accompanied by ordema particularly of the face and about the eyes. Other les common causes are urt carra erythromelalgia sinus th ombos intermittent hydrarthrosis tabes dorsalis and purpura haem rih gica O dema csp cially about the ankles & to be looked for in all the secondary a emi s of the tropics particularly malena and ancylost mass

Bersher -The orders begins at first about the feet especially about the dorsal junction of ph langes and met to sue. It is characteristically pretibal. It may remain confined to the hin or go up to the knees scrotum sternal reg on or trunk. It is gene ally symmetrical but may h undater 1. It may become a general anasare even inf ty-eight hours. The swelling of the face; at times normous the eyelids being so ordemat us that the pate at c n see o fy by separating them with the fagers. The oed m more solij than that I nephrat s It not only rap dly appe rs but disappears as ap dly The ordema f bemben may involve the glottis (o dema of glottis) Oed ma of genital regions is less in reed th ii in nephritis or cardi c disease. We may also have local ed are of edem 3 or 4 nch sin diameter. Ship beriberi which has points in common with both b ribers and scur y reveals ordems which in y be limited to the lower e trem tes rg neralized hp lemic dropsy is a type f benben in which there is fever and an crythema o er the drops cal areas

the lungs in which case the chocolate-colored liver abscess pus would be coughed up instead of comitted up

Rdapsing Feter -Bilious vometing may be a striking feature of the ictenc type of relapsing fever

I omiting Sickness -There is a disease known as vomiting sickness which has been noted in Jamaica. It occurs chiefly in children and has a sudden onset with marked comiting followed by cerebral symptoms and great mortality. Some thought the di ease to be yellow fever but the fever and saundice of that disease are absent. It is now recognized as due to acker possoning See p 1203

I ellow leter - In yellow fever there may be early vomiting of whitish or bile stained mucus but the well known black somet is a later feature only occurring after the fourth

day when the other haemorrhague manufestations set in

Neuritia - Inflammation of a nerve accompanied by pain and tenderness over the nerves involved with disturbance of sensation paralysis and disappearance of referes may be (1) Traumatic (2) Chemical (3) Infective (4) Metabolican origin The first step to an understanding of neurities is to determine the probable cause. Blumer Bearing in mind the seat of the lesion in multiple neuritis from different causes, may prove helpful in the diagnosis Generally speaking the following distribution is observed Alcoholic chiefly feet lead chiefly wrists atsenic all four extremities beribers all four extremities pellagra all four extremities diphthena palate rarely all four extremities puerperal ulna and median sometimes all four extremities

Alcohol - History of alcoholism a bilateral neutritis Pain and tenderness in the soles of the feet foot drop may have a not drop tender mu cles loss of deep reflexes tactile anaesthesia with hyperalgesia in the feet is characteristic. Aorsakoff a syn drome the loss of memory for recent events up a person who delights in fabrication of stories and reminiscences which he himself believes followed by hallucinations illusions delusions and disorientation as to time place and person completes the picture of Aorsakoff a psychosis.

Arsens -Arsenical neuritis may follow scute or chronic ariental poisoning-all four extremities are involved as a rule gastro intestinal disturbances enlargement of the liver jaundice and skin pigmentation belp differentiate from other conditions Harmorthagic encephalitis is a common occurrence from the so called delayed arrental

The van den Bergh test is of aid in diagnosis

Beribers -Beribers produces a polyneuntis Helpful points of diagnosis are (1) History of dictary descioncy (2) Oedema (net benben) has other form of neuntries accompanied by oedema (3) Loss of deep reflexes (4) Ankle drop (5) Anzesthena and numbress of skin (6) Jongkok test-the patient is unable to use from a squatting position if hands are placed over his head. In dry benbert the dietary history and the onset of muscle tenderness pain and weakness with dysphore and palpitation accompanied by dilated right heart and attacks of angina are suggestive of benbert. The neuritis of beribert standates and must be distinguished from neuritis produced by arsenic lead alcohol and pellagra

Batulism - The gastro interimal disturbance following diz mess and diplopia should make one think of botulism. This condition resembles excepbalitis lethargica anterior poliomycitis Landry's paralysis and the paralytic form of rabies. The finding of the Closi draw bottlenum is most important in diagnosis. For the demonstration of the to sine in the ingested food filtered extracts of it should be injected into normal guines gigs and in guinea pigs with immune serum

Diabetes - 1 polyneuntis characterized by pain paralysis and atrophy of the lover extremities is characteristic of dishetes. The finding of glycosums and hyperglycemia is diagnostic

Diphtheritic Pa alysis -- History of sore threat involvement of palate without ordema and failure of pupil to tract to accommodation or light should help in the diagnos 3 Leprosy - The spots in nodular leprosy show loss of pain and temperature sense with

retention of touch sensation

Pellagea -The history of defective diet symmetrical crythema more intense on those parts of the body which are not covered by clothing tremor of tongue weakness of headache is rather orbital and is often excruciating. There are also frequently heavy dull pains of the extremities

Oroya Fever -See anaemia and verruga

Paragonomiasis -See hiemoptysis

Paroxysmal Haemoglobinuria. - In this condition we have haemoglobinuma baemoglobinaemia fever enlargement of the spl en and h er and occasionally jaundice while in bl ckwater feyer 1 undee comes on early and is marked. The cause of paroxysmal haemoglobinuma is not definitely known but in the type incited by cold there seems to be as definite a relationship to syph his as blackwiter fever has to malana Reports show que have a postive Wassermann and recovery under antisyphilitic treatment has f equently been reported The Don th Landsteiner reaction is positive This disease is characterized by par x3 sms of haemolysis within the blood vessels. All the s gas and symptoms of this cond tion may be attributed to the rapid haemolysis of a large number of red blood cells. In materia saund ce is more marked than in par oxysmal hacmogl binuma For nocturnal paroxysm I hacmoglobinuma in which the Donath Landste ner test is negat ve see Blackwater fe er pp 148 and 1583

Pellagra.-In a typical case there is the diagnostic pellagrous symptom-complex (1) Symmetrical sharply outlined erytherna (2) Al mentary tract disturbances stomatit s ep gastric burning a d'diarrhoes (3) Neurological manifestations (See

neuntis)

Periodicity-Hala is shows a tyl cal periodic ty of paroxysms of chill and ele at on of temperature. At larnal paroxysms show a p eference for the forencon r arly afternoon I malignant tertiz there is a prolong d hot stage with gradual onset and the fever tends to remit or may remain cont amous for several days. The study of

such a chart is apt to sh w slight ri es very other day Pythis -This condition at times go es a regular p reducity of chills and fever resembling in larga. Ultim tely the fiver assumes the picket ferce type. Uni lateral par tenderness in the loss with frequency of urt ation are common Urinary

find ngs and negati e blood film for plasmodia differentiate from malaria

Rel pring Fever - The e or more pyrexial periods weeks apart are typical of religions Te chiferer frequently shows pyrexist periods recurring after 5-7 d ys. The num.

ber of relay sea of fever varies greatly from 3 t 5 are common

Undula I Feve -Wave like periods by of fever lasting for seven to ten days and

separated by afebrile intervals may auggest the diagnosis. However this per dicity is frequ ptly absent Phiebotomus Fever -(1) Presence ! Phiebotomus papatasu (2) Sudden onset

tempe ture 03-104 F frontal headache usually post-orbital eyeballs tender to pressure (a) M rked injection of co junctivae the i jecti n usually extending in a horizontal h nd across the eyeb il (4) The face and neck are flushed the redness resembling a rash which according to Castellan persists for o to 15 days after the fever subs des and fades away very slowly (c) Presence of a nd fly bites as fed punctures usually about the wrist a d ankles (6) Leucopenia. The fly penetrates 18 mesh screen

Photophobia - Influ za measles quim e po soning trich nosi typhus fever sm li pox sun light and syphilitic pachymeningitis re c mmon causes of photophobia encountered in the tropics. Ocular enchocerti sis also gives rise to photophobia in G atemala Mexico and parts of Africa

Plague -Chin cally plague is divided a to a mild form known as pestis in nor and a severe fo m pestis major

Pestis M nor - () Ambulatory form (2) Slight fever (3) Little prostration (4) Primary es ele or phlyetenule at a te of the fica bite

Pest s Major -In the more common and mo e a nous forms of plague we have two d stinct types (a) bubonic plag and (b) p eumonic plague Septicaemia is common in both forms and is often ec gazed as a sep rate type-septicaemic plague

Common to both forms are audden onset rigors rapidly rising and irregular tem perature g eat prostration confused mentality and inco ordination of speech with rapid, weak pulse

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Calabar Suellings -The e seem connected with infections with Loo loa The swellings originate suddenly and disappear in three or four days. They are hard and do not pit on pressure. These smooth swellings often 2 to 4 inches in extent are most often seen on arms face or ankles. It is suggested that they represent an allergic rise tion on the part of the tissues in response to the filanal toxine

Autonama Disease - The urticated areas of orderna have given it the name of

urticanal fever See p 1425

Trypanosomidsis -The pedema of the face and especially the eyelids may be striking especially in children in Chagas's disease. There may also be patches of oedema elsen bere

A peculiar disease of North China known as attriplicism is caused by the eating by the very poor of a weed firsplex common around Pekin. There is itching of the fingers quickly followed by swelling. This tends to extend to the back of the hands and up the outer surface of the forearm The face becomes so swollen that the cyclids may be closed See p gant

Pain.-Cerobalalgia rachialgia and the characteristic pain of certain diseases give

considerable information in establishing a diagnosis

Beribers -In beribers there is often gain in the engasting region so that the sh birst touch causes great distress This epigastric tenderness is also a feature of yellow lever The calf muscles are also markedly hyperaesthetic in beriberi

Blackwater Ferer-Pains in the lumbar region giving expression to the kidney damage done by the haemoglobin detritus plugging the tubules is a common symptom in

blackwater fever

Cholera -In cholera one of the most striking phenomena of the disease is the temble cramping of the muscles especially those of the calves and feet. These pains actually

torture the patient Dengue gives ruse to a marked post-orbital screness rather than pain. There is also a marked rachialgia with pains in the himbs often referred to the regions of the joints

which however are not swollen

Heal Stroke -- Cramps of abdominal muscles as well as those of extremities are often noted in heat stroke in men in hiercoms

Lepros) -In leprosy the neuralgic pains may be very severe through the inflamma tory reaction while the nerves are being pressed upon by the connective tistue increase of the endo and permeurium. Mention has been made of excruciating pains of the toes especially the big toe even suggesting goat

Molorie -In all forms of malaria but especially in the paroxysms of mahignant malaria there are severe headaches and pains in the extremities. Intermittent neuralgia

is often regarded as malanal

O oya Fere -In this very serious disease of certain areas of Peru the bone pains may be severe. These bone pains have been reported as especially marked in the sternum but also as involving the long bones

Pellagra - Pain on pressure on dorsal or lumbar spine is common in pellagra Plague may be associated during the first day or two with an excruciating headache

This may even be prodromal but tends to disappear with the rapidly developing stunorous state of the patient

Relaying Firer -Bone pains especially referred to the knees are complained of by

patients with the bilious typhoid of Gnesinger This is a type of relapsing fever occur ring in Egypt Trench Peter -Pain over the shin bone is a prominent complaint in this affection so

that the term trench shin has been employed Trypanasomiasis -In trypanasomiasis headache is often marked together with a

characteristic deep hyperaesthesia so that the striking of a himb against a hard object gives rise to ex ruciating pain there being honever a delay in the experiencing of the painful sensation (Kérandel a sign) Undulant Feter -- In Malta fever the neuralguas especially sciatica often associated

with suddenly appearing painful roust swellings are prominent features

I ellow fever is marked by pains in the lumbar region the coupe de ba e of the French as if the patient had been beaten over the small of the back with a bar of iron The

Relays & Ferer - In relaysing fever there is frequently a moderate bronchitis at the time of the first fehrile accession

Typhus Fever - Bronchopneumonia is probably the most common complication of

typhus fever Undula I Ferer -- This disease tends to show a brunchial involvement about the twelfth day of the disease. Crepitant rales a moderate cough and slight dysp note may be noted. It was the presence of pulmonary signs along with the profuse sweating and anacmia of the disease that justified the des gnation Med terranean

Pulse —In vellow fever a markedly slow pulse between 40 and 50 is often recorded

about the time of the remission (sed or ath day)

Queckenstedt Test.-This test consists of lumbar puncture with the needle con nected to a manometer for recording the intraspinal pressure. After n ting the pressure the internal jugular veins a e compressed to produce a cerebral co gestion. Imme di tely the pressure of the intracramal fluid is raised and produces an increased p essure of the intraspinal fluid. This elevation is noted by a sudden rise in level of the fluid in the manometer and is followed by a sudden decline o releasing the jug lars. Any serious narrowing of the si inal canal between the cramium and the point of the needle will cause the fluid le el to rise more slugg shly and the decline will likewise he slower than normal. In the event the canal is completely closed, the compression of the jugulars will not affect the le el of the flu d in the manometer. This test is e pecially valuable in confirming the presence or absence of obstruction or narr wing of the lumen of the somal canal. It is indicated when one suspects c rebroson al block syringomy clia fracture or dislocation of spine agen I tumor or any condition which may cause senous narrowing of the spinal canal

Rat B te Fever - The following points should be looked for (1) Sudden onset with chill (2) Th breaking down of a prev usly heal dwound or inflammation surrounding a cicatria from 6 to 8 we ke old (3) Lympha gitis and lymphadenopathy (4) Sp rilla in the blood. For definite d. gnos s the inoculation of a guinea pig may be

necessary to demonstrate the Spiritura Reflexes Altered - Diseases in which alte ed effex s and motor disturbances are of diagnostic alue are included under this beading. Diff rential diagnostic data in regard to sensory disturbances when accompa ed by altered reflexes are included

Beribers -It is usually stated that the tendon refle es of the lower extremity especially the patellar redux a e absent. While this is g nerally true they may at first show an exaggeration and some cases do not seem to sho any decided change There may be striking variation from d y to day in the reflexes. The superficial reflexes especially the cremasteric ar as a rule in reactive than no mally

The se sory changes in beriben are less marked thin those of the motor a de There is rarely complete anaesthesia but athe a blunti g of sensation. Hyperaes

thesta particularly of the muscles of the calf f the leg is well marked when the muscles are grasped with the hand

The an eather a is earliest moted over the shin bone and dorsum of the fot. A loss of tactile sense is ften noted at ut finger t us making it difficult for the patient to button his coat The most striking moto phenome a are the foot and wrist drop e pecually the former. The extensor muscl's are more mark dly invol cd than the fl zors. There is marked muscular weakness f the foot as well as the hands. The weakness of the muscles of the leg is often the first symptom to be complained of The type of palsy in heithers a massly pa aplene although hemiolegic and monoplegic types ha e been reported. The paralysis of the daphragm is the most serio a of the muscle palsies

Contractures of the mus les of the foot or calf of the I g may occur Contractures of the muscles of the upper ext emity re m re ra e Muscular atrophy of the leg muscles is often marked. In the upper extremity the mustles of the hand a e most frequently atrophied

Kub s tors - See paralytic w riseo below

Lathryum -In lathryum we have spast city and an exaggeration of the reflexes.

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Butonic — The pathognomonic painful bubo appears about the third or fourth day. The buboes appear in the inguinal region navolving the femoral glands (10°) sullary (10°) and the submaxillary and cervical (5 to 50%) very characteristic of plage buboes is the orderna of the periglandular issue.

Presumence—In the course of an attack of pents major subout bulies we may have grave pulmonary symptoms develop. Early depones, shallow expections with the expectoration of abundant waters sputam which later becomes blood larged abboutlets resumenced without seemingly sufficient cheet findings should make our gravely suspection of plague. There as never the rusty tensious sputum herper or partial responsation of lobar nonemones.

Polycytherms.— In increase in the red blood cells is noted in cholera to 8 to 9 millions. A high red cell often occurs in Sorroche (Peruvain mountain sickness) and in the nature who reade in the high stitudes of the Andes (especially Peru and Bohras).

Polycytosis -An increase in the cells of the blood both crythrocytes and buco

cytes is characteristic of cholera

Pulmottary—We have included as pulmonars symptoms of tropical diseases those due to involvement of the iung as the result of direct invasion by the infecting organism as to preumonic plague as nell as those regarded as secondary to ovasion of the strictures as in malaria and relapsing fever

Ancylestomiates —In hocknorm disease cough and bronchits have been reported and it seems probable that such manufestations may be connected with the course of the large at faceough the pulmonary passages to reach the intestinal tract

Broanties Spinochaeless:—There is a condition which most or less retemble lobar between the condition of the condition with the condition and with negture roentgenograms when we find approchaetes in the sputum. In another type of broantial spinochaeless the climical picture is more that of pollonary tuberclimes. There is a question whether these spinochaetes are causative or only strondary of

accidental

Filariasis — The filarial embry os of H. bancrofts remain in the lung capillaties during

the day and such embryos have been found in blood coupled up from the lungs Gulo — In Guam there is 1850 a rather fatal capillary bronchits effecting young children with h goes and t the rame of epidemic asthma or as termed by the nature.

guha Tr a affection comes on during the carry sexton and is attended with market dysproca and slight elevation of temperature Heat Stoke --Cheyne Stokes respiration and pulmonary ordems are often observed

their stock—Lucyne Stokes respiration and pulmonary occurs are stoled on their stoke.

Japanese steer fleer often abone bronebal sovolvement and cough at the time of

the height of the fever

ton begin of the lever.

Autayation districts may show a locals of brunchsts rarby in the attack and from fits rapid appearance and disappearance would seem to be a sort of patchy polimonary ordered. This is connected with the passage of the larvae through the lungs A similar bronchitts has been observed an infection with Schistesome neemales an in Africa and S moroses in the Vest Indees.

Liet Absets: In liver abaces the crepatation at the base of the right lung following congestion includest to the abacess of the right labe of the liver is of value in diagnosis. Rupture of a liver abacess into the lung occurs in a bout 10% of untreasted causes the contract of the contract of the contract that the contract types and some

Molaria - In milaria we have a slight broughtles to the ordinary types and some recognist a pulmonary type of permitions malaria

Monital Infected to — Class have been reported where a phthissa like condition was due to a mould infection (Mon Me). While such a condition may be privary it is more often secondary in cacherus as may be the case with bureal Monita infections.

(thrush) which occur in the vi tims of eachering states.

Playur -Playur parumonis is characterized by profound prostration in a patient
whose physical signs often do not seem to justify such extreme illness. The rather
abundant and vistery sputting soon becomes sanguagedent. Herper labulus is absent.

shoulded and vatery sputum soon becomes sanguagedent. Herpes labalic is abent Besides pamary plague parumons which develops directly from contact with a forest case we have a secondary parumonic which develops in the towns of a typical case of bubonic plague as a metastatic phenomenan.

De que -The true eruption of dengue is the one that appears about the fourth or bith day as a measles like erus tion starting about the wrists or ankles Dermat tis Due to Schistoson s -- Cort (1038) reports a number of cases of derma

titis of a papular to pustular nature occurring in the state of Michigan (U.S. A.) produced by penetration of the skin by schistosome cercariae. Certa is of ca

This form of dermatitis is common in other localities See p. 1413

Es de me Dossy -It has been a question whether such a d sease as er idemic dropsy is distinct f om h riber. An erythematous eruption about the face and a macular one of the trunk and extremities are usually stated to be features of this disease. See n ork

Filarias t-The cutaneous manufestations of filariasis include (1) the bleb like les n which disclose when the guinea worm is about to pierce the skin (a) the Calabar swellings produced by log log (3) clephants sis a dlymph acrotum and filari labscesses due to Il ba or fis O obute for cocentrens) gives rise to nodules or tumors on the sides of the chest about joints or on the back or so lp They are usually quite super feral w th the skin freely movable o er them

Juxto-a t culor A odes -This is a condition to which small tumors form under the skin especially in the region of the cibous. These bean to walnut sixed tumors of the subcutaneous tassues m y also be noted about the knees. A fungus has been reported as the cause but the present view is that the condition is generally a nequel of yaas

Ada a a -There is a darke ing of the colored skin of the nat ves suffering from this di case and it is to tha feature that the disease owes its name (Black mckness) In Europea a the appearance is in re that one sees in old malarial cachectics an

earthy-gray color. The characters two of cutaneous its hmanus a are discussed under that heading

Oriental Sore is especially comm n : Asiatic Turkey and Northern Africa. It begins as a small papule which e entually ulcerates the sora scabbing over from time to t me and again breaking d un Indolent granulations and a very protracted course are rather characteristi features. It is due t. Leichma a trapica

Leishing as -Ih most moortant point of differents to n of Amiscan leish manus is from oriental sore is the occurrence f ulcerating les ons of the mucous mem branes of mouth or nose subsequent to the appearance of the oriental sore I ke let one on forearm legs trunk or rarely the fa e I Peru the term win more properly belongs to the skin affections while e p nd a is the designation applied to the lesions of the mucous membranes. It may be tated that a form I openial sore has been reported I om Creece where mucous membrane ulcerations have hen associated with the ordinary ski type lesion

Br hmachan has described a form of generalized cutaneous leishmanias s bearing a superficial resemblance to becrosy which may develop a variable number of months after apparent cure of kala azar by antimony. Having f and leishmania bodies in the I sions he conjectured that some of the p rasites survice the action of the drug but with their virulence attenu ted that they can give rise only to a milder disease a variant of cutaneous leishmaniasis to which he gives the name dermal le shinanoid SC D 270

Lep ory -In nodular lepr sy there may be the appearance of macules of greatly varys g sure and shape with a t ad new sooner or lat r to symmetry. They tend to appear and recur in assoc ation with tebrile accessions and e en when they have become permane t spots they show mereas d redness infiltrats n and tension when there is lever The color is rather that of a sunburn and may be uniform or the center may be fale with copper-colored periphery. The e spots app at by prefere ce on face backs of hands buttocks extensor surfaces of extre mues and back. Th y may mark the location of later developing nodules At first they are only r ther th n scaly Soon there is n ted a disappearance of hair within the spot. These spots soon tend to become an eather c The t he cles of leprosy are usually of a redd sh brown color

In nerve leprosy the spots tend to appear on parts of the body usually cover d hy clothing as scapular regio shoulders rims thigh o buttocks. The outline is ovoid

Leprosy -- The usual statement is that there is an exaggeration of the deep referes Ankle clonus has been rarely reported

Anaethesia is the most important aymptom in the diagnosis of legroy. This loss of sensation in offer for your and temperature with returnion of sactice sense sociation of sensation—a prominent symptom of symptomy call.) The sacreticus is not only found in the spotts but associated with the legrous centrals which involves the ultrar facral and personal nerve. Mustle paises and atrophes are common and the name or neff exportance of the hand is seen.

Paraljus Vertigo—A very remarkable disease called kulusigan or paralytu vertigo has been observed in Japan. This disease is thought to affect those living in stable and the attacks only last a few munutes and at other times the patient seems normal During an attack there is ptous and diplopus speech disturbances and palsy of the muscles of the back of the next causing the head to fall forward. There may also some paresses of the muscles of the muscles of the mascles of the mascles of the first of the seems of the mascles of the seems of the muscles of the seems of the muscles of the extrematics.

Pellagra —There is considerable variation from time to time in the reflects. Some authorities attach diagnostic value to the appearance of an exaggerated refles on one acide and a gimmultion or a bence of the corresponding reflex on the other side. Anhie changes may be present. Paraesthesias and in particular a burning sensition of the expression and the present and the properties of the during an acide of the present and the properties of the during and includer regions to often noted. Pruntus nat times complained of in the region of the perineum. There is generally muscular weakness.

Sleeping Suckness -The deep reflexes are usually exaggerated and the superficial

ones diminished or absent

There is no distinct alteration of motor or sensory function except that of deep appropriately the sensor of the muscles of locomotion.

There is no distinct alteration of motor or sensory function except that of deep locomotion.

There is no distinct alteration of motor or sensory function except that of deep locomotion.

Relapsing Ferer —(2) Sudden onset with rapid rise of temperature to rot or 10, F

(3) Billious vormiting (3) Leucocytosis (4) Remissions of 3 or 4 days followed by
a second third or additional pyersual periods

Rocky Mountain Spotted Fever -See typhus

Schistosomasis.—In both rectal schiatonomasis and Japanese schiatonomasis there may be fever consopolius and uticarial cabels as strip manifestions. The same phonomena may characterize the onset of the vested form (due to 8 Accessivation of this group of befundruc infections. Cystics and excased calcions are the symposium which particularly characterize the latter infection. Subjections are designed which particularly characterize the latter infection while dynemene manifestions are often associated with the rectaf fluke. Particularly the substitutions of activations and China may lead finally to curbons of the liver active and a terminal cachera. Schizionom Acc noblemum may have note to Exercistan subconnectics.

Scrotum.—The following conditions are frequently found in the tropics (i) Hydro-Scrotum.—The following conditions are frequently found in the tropics (i) Holic cele of the tunica vagunalis (i) Lymph scrotum from Fildrie (j) Boilt (4) Syphilis (g) Valignancy The examiner should prove that the swelling is not due to herma in

(5) Valignancy The examiner abouild prove that the swelling is not due to herma in every case

Hydrocile—The tunica vaginalis may become distended with fluid Except in

cases of thick wall hydrocele they are translucent while a harmatocele is not All hydroceles fluctuate. Filanal infections of the tumes are not rare. Such a condition is called chylatus hydrocele.

Sing Lemma of "Nagreem infections of the skin act so common in the topics that our should always make an examination for the cuarsive figury when doubt is to the nature of the lemma cause. Another point as that many hyperaemus incident to other diseases seem to formah favorable soil for fings; thus to infectionally Shitt found abundant spores and mycloid structures in acroping from the crythems of the early spihilut secondance. Again prunite lessons may become infected with foung as the result of scratching which scritching may not only have this result but furthermore may obscure the demnatological characteristics of the pinary distass.

Ancilostomicsis -- Its ancylostomicsis the site of entrance of the infecting stage of

the larvae is marked by a dermatitis-ground sich

Desgu -The true eruption of dengue is the one that appears about the fourth or fifth day as a measles like cruptuo starting about the wrists or ankles

Dermat (5 Due to Sche tosom 3 - Cort (2018) reports a number of cases of derma titis of a papular to pustular nature occurring in the state of Michigan (U S A) produced by penetration of the skin by schistosome cercariae Cr ca ia often

This form of dermatitis is common in other localities See p 1433

Epidem c Drop v - It has been a question whether such a disease as epidemic dropsy is distinct from benben. An erythematous eruption about the face and a macular one of the trunk and extremit es are usually stated to be features of this disease See e rors

Filanaus - The cutaneous manifestations of filanasis include (1) the bleb like lesson which disclose when the gumes norm is about to pierce the skin (2) the Calabar swells as produced by Ioa loa (1) elephantiasis and lymph scrotum and filarial abscesses due to If ban rolls. O tol ulu for or utens) gives rise to nodules or tumors on the ades of the chest about joints or on the back or scalp. They are usually quite super ficial with the skin I cely mo able over them

Junia-act cul Nodes - This is a condition in which small tumors form under the skin e pecially in the region of the cibows. These bean to walnut sized tumors of the subcutaneous tissues may also be noted about the knees. A fungus has been reported as the cause but the present view is that the cond tion is generally a sequel

of yans

Kalu-a.a -There is a darkening of the colored skin of the natives suffering from this disease and it is in the feature that the disease ones its came (Black sickness) In Europeans the appearance is more that one sees in old malanal cachectics an carthy gray color The characteristics of cutaneous I s hman a is are discussed under that h ad ng

Onental Sore is e pecially comm a to Asiatic Turkey and Northern Africa 1t begins as a small papule which eventually ulcerates the sore scabbing over from time

to tim and again breaking down. Ind lent granulations and a very protracted course are rather characteristic I atures. It is due to Leithmania Irop ca

Leisk ian s : - The most important point of diffe entation of American leish mamasis from oriental sore is the occurrence if ulcerating les one of the mucous mem b axes I mouth or nose subsequent to the appearance of the me tal sore like I sions on forearm legs trunk or rarely the face. In Peru the term uto more p operly belongs to the skin affections while esp : d a is the designation applied t the lesions of the mucous memb anes. It may be stated that a form of oriental sore has been reported from C reece where mucous m mhr ne ulcerat ons ha e been associated with the ordinary sk a type lesson

Brahmacham has described a form of me e alized cutaneous leishmaniasis bearing a sup racial resemblance t leprosy which may de clop a variable number of months after pparent cure of kala a or by antimony Having i und leishmania bodies in the lesions he conic tur d that some of the parasite urv ve the action of the drugbut with their virule ice so attenuated that they can go e rise only to a milder disease a variant f cutaneous leishman asis to which be gives the name dermal leishmanoid

see p 270

Lep say .- In nodular leprosy there may be the appearance of macules of greatly varying size and shape with a tendency sooner o later to symmetry. They tend to appear and recur in ass ciation with febril accessions and even when they have become permanent spots they show mer used red ess infiltration and ten on when there is ie er The olor is rather that of a aunburn and may be us form or the center may be pale a th copper-colored pemphery. These apots appear by preference on face backs of hand buttocks extensor surfaces of extremities and back. They may mark the I cat on of later dev loping nodules. At nest they are only rather than scaly Sonn th reis not dia disappearance of hair within the s; t These spots so n tend to become anaesthet c The tubercles of leprosy a e usually of a reddish brown color

In nerve legrosy the epots tend to app a on pa to of the body usually covered by clothing as scapular r gion shoulders a ms thighs or bottocks. The outline is ove d 1662

rather than round and the spots may at first be hyperaesthetic rather than anaesthetic as they later tend to become In circunate eruptions there is often noted a pale center with brownish red borders. These borders may be hyperaesthetic while the centers show anesthesia. Bilateral symmetry is more common in this than in nodular leprosy Besides the spots nerve leproxy may show blister like lesions on the backs of hands and feet especially in the region of the knuckles. Ulceration may follow

Molario -- Herpes in more common in benien types than in malienant ones Urb carra is next in frequency. Malaria has seemed to be the cause of certain cases of

purpura simplex In attributing akin manifestations to malanz one must always have in mind the scarlatinulorm urticarial and erythematous rashes that may be due to quinine and arsphenamine Toxic rashes with fatal results also occur from sulfamismide and sulfathiazole

Pellagra -In no other general disease is the skin emption of such importance in diagnosis and it is practically impossible to make a sure diagnosis of pellagra in the absence of an eruption or the history of an eruption. The eruption tends to show itself in the spring but may first appear in the early full. The lesions resemble a sun burn and burn instead of itch. The characteristics of the eruption are bilateral sym metry and sharp delimitation from the sound skin

As a rule the lesions are dry and atrophic but more rarely and usually in severe cases the eruption may be moist and ordematous. The backs of the hands are the most common sites for the eruption but frequently there is an extension up the forearm. The neck the bridge and size of the nose the region back of the ears and the front of the chest are often involved. In children the feet and legs are frequently involved. Scrotal

eruptions are early manifestations

Plague - Very rarely eases of bubonic plague may show a small vesicle marking the site of the fien bite Areas of necrosis of the skin which are really sloughing patches and incorrectly designated carbuncles may be noted especially over the site of the bubocs

In the later stages haemorrhages into the skin (petechiae) are common Prickly Heat -This condition is extremely common in the tropics and the scratching

to relieve the stching often leads to infection with fungs or progenic cocci

Rat Bile Disease -An eruption of purplish spots may accompany the lever There may be a resemblance to erythema multiforme

Trypanosor mass - Patchy areas of crythema are often noted in Europeans affected

with this disease. These are frequently circurate with fading in the center and tend to appear on the trunk Trutsugamust : - 1 small necrotic ulcer with a dusky red areola often located in the armpits or region of the genitals marks the site of the bite of the infecting mite From it a lymphangitis leads to the swellen glands. About the seventh day a

macular ecuption which never becomes petechial appears on face then on trunk and extremities

Tulo sen to .- There is often a local lesson at the site of the bite of the infecting Chrysops The tributary glands are swelled

Typhus Terer -Gangrene is particularly a feature of spotted fever of the Rocky Mountains and typhus fever chiefly of the scrotum and prepure with the former and of the extremities in the latter. In typhus there is a macular ecuption which becomes petechial

Unicareal Fere -In Japanese schistosamiasis often the earliest symptoms are the

urticanal rash and fever

Skin Pigmentation of -It is well to bear in mind that the normal skin pigmentation in the negro race is black and that true pathological skin pigmentation as in Addison s disease will therefore be black and not bronze Statt has observed light colored members of the negro race become glossy black due to tuberculous Addison s d: case The gams and buccal mucosa of the negro normally have a blush tinge and in healthy persons of negro ancestry there may be such a buccal pagmentation The first step in determining the cause of skin pigmentation is to determine by the van den Bergh test if the color is due to an excess of serum bil ruban. This is a rapid diagnostic aid and differentiates the skin pigmentations due to serum bilirubingenia from those produced by other causess. The main causes of skin pigmentation are pellagra arsenic therapy syphilo derms malatial cachevia acurvy malignancy goiter diabetes mellitus, nodular leprosy Add son s d sease pernicious anaemia and vagabond a discoloration due to Pediculi The mongolian snot is a currous manifestation of pigmentation which consists of one or more blush dark snote that appear at buth in the sacral lumbar and gluteal regions They resemble somewhat the black and blue marks that may appear on the skin after a contusion According to Simon (so40) the mongolian spots are more distinct the first two weeks after birth be oming fainter and disappearing in from two months to two years Sinety per cent of Japanese infants are so d to have them and they are common amo g ; fants of the Javanese Malays Chinese and tribes of the American Indians In a pegro the mongolian spot as ra elv absent several of the spots usually being present. They have also been found in a few instances among Russians, the natives of Greenland and the darker Mediterraneau white races However Hooton (1040) no n a out that the n eserce of mon olaid spots is suggestive but not definite of negro blood, as it may occur in infancy in many of the darker pigmented races. Hence the present e of these spots is not defin to evidence of negro heredity. Other features which have been considered as indicative of negro blood, such as increased pigment in the eyes and nails and blood tests lead to the conclusion that there is yet no kno in scientific test that will identify negro her d ty Snake bite - The d agnosis is based upon the history of bite followed by swelling of

the limb or area bitten P in nauses womiting and collapse. Later bleed og from the mucota and from the fang puncture. Bleeding from goms and nose may be profuse Snake bites usually occur on foot ankle hand or forearm Individuals should be taught to kill the saske responsible for the bute and to take at to the dispensary or hospital where it may be identified thus sflording the possibility of secenying specific treatment

Sea chapter on poisonous snakes p acro

Somnolence - The disease in which this symptom is most prominent is sleeping sickness. The patient may go to sleep lying in the bright sunlight or in the midst of esting a morsel of food. The e cases can be easily aroused but quickly drop off to aleep afterwards They often deny that they were askep Later on an alceping sickness the patient may sleep from 14 to 36 hours continuously and a more marked tendency to somnolence may be present by day than by night In the prodromal st ge of leprosy summolence is often marked and accompanied by a sensation of unsecount this weakness Swests gs and accessions of fever may also be noted at this time In plague the rather stuporous state of the patient may give the impressi n of somnolence

Spicen Enlargement of - (Spichomegaly) The best method of detecting moderate enlarg ment is hims nual palpation. The sple in descends with inspiration and the hand cannot be inserted between the mass and the left costal margin. If a notch is felt in the right free border one may be reasonably sure of an enlarged spleen. Enlargement of the spicen may cause the appearance of palpable tumor in the left hypothondrium and may e en extend below the umb h as or into the pelvis causing visible onl I gement of the abdomen The normal apleen is of p loable. The spleen is enlarged in typhoid fever cirrhos s of the liver mea les sickle-cell ansesma and solects e endocarditis. In the

foll wing diseases it is an impo tant diagnostic sign

Blackwate Fe c - The spleen s pa nful and enl reed. The splens enlargement in the disease and relapsing fever is important in differential diagnosis from yellow feve a disease in which the pleen is maffected

G sicher's Di e 3 -bpl me nlargement leucope sa chronic cour e with a brownish to grays h skin d sc lo ation is pres ut

He moly! In nd ce-Enlarged spleen a nemus diminished res stance of the red cells to hypot nic salt a luti n (0 54 to n 62 " NaCl) and the presence of ret culated red cells Jaundice is common and this aids in differentiating othe firms See p 1687

K I -a a -The aplenic enlargement is the most con p cuous change in the disease the spleen often re chi g the mh hous by the third mouth and later possibly filling up the entire I ft side of the abdom u The connectent emacration of the pat ent makes the splenic tumor more app e at. When first culargin, the spleen may be the source of c us decable pam and tenderness

Fluctuati us in the size of the spleen is we been noted in the course of the disease d minution in size often attending severe dis the alattacks. In spicen or liver puncture the needle must be dry so that the parasites shall not suffer distortion

Leukaemtar - Gradual painless culargement of the spicen to an enormous size is characteristic of myeloid leukaemia lymphatic leukaemia pseudo leukaemia infantum

Malaria - Splenie enlargement and tenderness are important points in diagnosis of In acute malignant tertian infections the spicen is often difficent so that it is hable to rupture upon slight injury. The palpation of the spicen in acute malana is a difficult procedure lithough it may be considerably enlarged it is so soft that palpa tion is difficult. One should even exercise care not to palpate the spleen too violently and the possibility of accident should be thought of in making a spleen puncture The typical malana spleen is the ague cake of malanal cachesia. Here we have a greatly enlarged spicen with a thickened capsule and firm consistence. This spicer may fill up one side of the abdomen.

Malla Ferer -The splenic enlargement in this disease usually corresponds about to that of typhoid fever. At times, however, the size may be so great as even to suggest kala-azar

Relaying Ferer .- Spleme enlargement and tenderness are marked leatures is this

disease often being noted early in the course

Rickets - The spicen may be readily paloable to rickets. The maloutrition rachiti rosary presence of Marrison a groose projection of sternum painful joints craniotabes enlarg I abidomen profuse aweating and tendency to atony is present. Blood chemistry shows reduction of morganic phosphates

Rocky if ounts in Fever - One point of distinction beingen spotted lever of the Rocky Mountains and typhus fever may be that the spicen of the former disease is usually enlarged three or four times the normal while that of typhus fever shows no increase in size The paipable spleen of Rocky Mountain fever is firm instead of soft as with tvohus lever

Schistoromiana .- The apleen may be enlarged in Japanese achistoromians as well as

in African schistosomiasis due to either S hoematobium or S monsons

Splente Anaemia -- (Banti s disease) Enlarged spleen leucopenia recurring hematemens and secondary ansemia. Must be differentiated from typhilis with anaemia accompanied by splenomeraly

Syphilis -In congenital syphilis the spleen is often enlarged along with the liver In syphilitic curbosis of the liver the spleen may be greatly enlarged Syphilis may be the cause of the same climical and blood picture as found in Barris disease. Syphi'is may produce an anaemia associated with aplenomegaly and every such case basing a positive habit serum reaction should be regarded as fuetic until proten otherwise

Sprue - The interesting disease may be diagnosed by (2) Diarrhoes with the characteristic white stools which may be intimately mixed with bubbles of gas giving them a frothy appearance (a) Tongue and mouth lessons in which the tongue is denuded of epithelium and shows inflammatory changes (3) Loss of weight Ansemia may be moderate to severe. The red blood count may fall to 1 000 000 per c mm and resemble the picture of permicious snaemia (5) Small liver (6) The neutral fat and fatty acid ratio in sprue may become t-5 against a normal of neutral fat t fatty acid 2 Sproe may minulate permicious anaemia pellagra malignancy of the pancreas syphilis and dysenters. In malignancy of the pancreas the neutral fat and latty seed ratio helps differentiate as in this condition the neutral lat in the stool may be as high as a to fally acids a Territious anaemis syphilis and dysentery may be differentiated by thorough laboratory study and the absence of true sprue stool differentiates pellagra. Sprue is now recognized as a nutritional deficiency disease See diarrhoes for etiology of tetany in fatty or chylous diarrhoes Stomach and Oesophagus, wery important in diagnosis is a tenderness in the

pylone end of the stomach which is brought out by attemption to purpate the epigastric region It is often marked in yellow fever and acute permitives beriber as well as in blackwater fever and bobous remittent fever. He also frequently have epigastric tenderness extending to the right in ancylostomians. Hooky orm patients are often pot bellied and the crasing for eating unusual articles as earth may be connected with the gastric hyperacidity which the patient desires to neutralize with alkaline earth

Pellagra gives eructations and pyrous and very common is a burning sensation

extending from the stomach along the une of the pesophagus

Sprue gives rise to a flatulent dyspepsia with gaseous eructations. In sprue there is often a raw sensation in the ecophagus o that awallowing is painful

Strongyloides -- See diarrhoea

Syphilis Hereditary—A syphilitic child is never born of a non syphilitic mother A syphilitic mother bowever may give birth to a non-syphil in child

Discusses with Sundern Ruse Emperature remanagle should as some security of the control of the c	what is the control of the control o

Pig 396 -Gene altyp ff ve on et nth v mou topeld en e

Temperature —While a knowledge of the vanations in type and course of the body temperature in the vanous tropical dues as in y be of great alue in diagnosis yet such informatin is a lable tiled one astray unless such data are controlled by a careful consideration. I the other and mor important factors of physical diagnosis and labora long examination.

The idea that there is a scientific at cities in the employment of the clin call the momenter tried to make one overseimment is value in diagnoss. I thouse termembered that the byhair temperature one encou tern a the t-opics affects the clinical termome stre which is of the maximum type. This is particulal by true when the sum may be shunge on the container in which the the m meter may be kept. Even if one shakes down the column of mercupy before putting it in the mouth the same plass of the waterinent will quickly cau eithe mercury column again to rise. It should be a practic to place the instrument in cool water before in critical in the mouth and are mount in the forget that a wiffer in trent on in the mouth fr m two to five manutes may be neces any in once in section as the column ages to see the column and the mouth of the state of the manutes may be neces any in once in section as the column and in the mouth from two to five manutes may be neces any in once in section as in the mouth of the mercand.

Discovers well Crisis Discovers well crisis Discovers well crisis Discovers well crisis Discovers well crisis Discovers well a second of the crisis of the critis of the crisis of the crisis of the critis of

Fig 397—Gen 1 typ f t rm n ti n of th f brile o n th v our tropic 1 de 2

For practical purposes we may divide tropical dis uses from a standiform of body temper ture intituo classes. (1) Trops of easers which the bise es of fevers the ern of cours of the illustrate at d. (2) those discussion which the present of fever in the present cours of the illustrate present.

The di a es in which the presence of f ver in the general c urse of the illness is the rule in y be considered in two gloups (1) Those is which the temperature chart is 1004 APPENDEX

Leukaemias — Gradual painless enlargement of the spleen to an enormous sue is characteristic of myeloid leukaemia lymphatic leukaemia pseudo leukaemia infantum

Molarus — Spleme enlargement and tenderness are important points in diagnoss of maria. In acute malignant tertian infections the spleen is often difficult is that its labels to rupture upon alight argury. The pulsations of the applien in scute making as difficult procedure. Although at may be considerably enlarged it is as soft that pulps ton is difficult. One should even exercises care not to pulpate the applient too valendly and the possibility of accident should be thought of in making a spleen paneture. The typical malarus spleen is the ague cake of malarul cachena. Here we have greatly enlarged spleen with a shockened capsule and firm consistence. This spleen was full one and of the abdomation.

Mallo Ferer —The splenic enlargement in this disease usually corresponds about to that of typhoid fever—At times however the aire may be so great as even to rogget kala azar.

Relapsing Fiver - Splenic enlargement and tenderness are marked features in this disease often being noted early in the course

Rickets—The spleen may be readily pulpable in takets. The malautition rath at roary presence of Harrison's groove projection of steraion painful joints cranolibes conlarged abdomen profuse an eating and tendency to atony is present. Blood chemistry about a four-ratio chosobases.

anous reduction or mogranic phosphages.

Rechy Mountain Freet "One pount of distinction between spotted lever of the Ruchy
Mountains and typhus Server may be that the sphen of the former d, ease is usually
contarged three of true times the normal while that of typhus fewer shops no metrical
in user. The polyable sphen of Rocky Mountain fever is firm instead of soft as with
two baselons.

Schistosomians - The spleen may be colarged in Japanese schistosomiasis as well as in African schi tosomiasis due to either S. haemalobium or S. manions

Splenic Ansemia—(Pontis di esse) Enlarged spleen leucopema recum s bematemesis and secondary anaemia. Must be differentiated from syphi is nith

anaemia accompanied by splenomegaly

Syphits—In congenital syphilis the spicen is often enlarged along with the liver In syphitise cirrbons of the liver; the spicen may be greatly enlarged. Syphis may be the cause of the same climical and blood poeture as found in Banta disease. Syphis may produce an anaemia associated with aphenomental and every such case having a posture. Askin securit exaction is hough be regarded as better until prover others a

positive Kann greum extends in run of expenses a new point of the control of the characteristic white stocks which may be disapposed to (1) That nees with the characteristic white stocks which may be used more than the characteristic white stocks which may be used more than the characteristic control of the public of the characteristic control of the public of the characteristic control of the characteristic

Stomach and Oesophagus—'tery amponism in diagnosis is a tender or in the pylonic and of the stomach which is thought out by attempting to pall at the experience region. It is often marked in yellow fever and acute periorious bribers as well as in blackwater fever and bihous centitien fever. We also frequently have typesent tendencies extending to the right in arciplostomasm. Hooknown patients are often pot bellied. and the craving for exting unusual actiteles, as earth may be connected with the gastuch hyperacidity but he patient deserts to neutralize with alkalize arthin.

Pellogra gives etuctations and pyros a and very common is a burning sensation

extending from the stomach along the has of the ecsophagus

sion give the temperature picture of a continued fever in which periodicity is not easily noted. A study of such a chart will probably show that the curve tends to approach normal every other day The suggestion of periodicity is almost of as great value as the actual drop to normal in the intermission. The remittent or even continu ous two of fever in malienant tertian tends to wold to an intermittent one after a week or more of such fe er

be y characteristic of malignant tertian parosysms is that they set in with chilly sensations rather than a frank chill It is for this reason that the so-called dumb shill is rec enized as more serious than the frank urmistakable chill. The main featu e of malignant tertian paroxysms is the pronounced and prolonged but stage which frequently lasts from twenty to thirty-six hours and may run over into the using temperature connected with the development of the succeeding generation of parasites

The terms anticination and nostponement are frequently used to explain the drawn out fever of this type of malaria. There is great irregularity in time of development so that we get the impression of completed cycle bef re the accepted forty-eight hours as sh un by a rising temperature within thirty-six bours--anticipation or instead of shows g indications of a compt tion of eyels in forty-eight hours the f ver still keeps up-retardation. The descent of the fever curve is much more gradual than the rise at the onset of the paroxysm. The fine hair like rings of the tropical paras te are the only schi ont stages usually found in the peripheral blood. As the rings enlarge they fal to appear in the pempheral blood so that blo d examination at such times will be negati e. The finding of crescents is n oof of a malignant tertian infection

I I view of the fact that one is likely to fail to find parasites just before or just after a paro yam search should particularly be made I s the pigment carrying phagocyte-

the melan f rous leucocyte In certain of the permicious manifestations of malignant to tian especially the hyperpyrezial type of cerebral malana the temperature may reach a very high degree roy I to 110 ! and it is often mistakeo for sun stroke by one not familiar with the

fact that so called sun stroke a often only this fatal form I malana

In aigid pern clous malaria the auditary and, o part cular the rectal temperature remain elevated even with subnormal surfa e temperature

The infection in latent malaria is most often a malignant tertian one. Such cases often d velop paravysms i llo vine surgical operations in at time of presnancy or child birth. Clark and others have noted the abundance of parasites in smears from the placents taken at time of delivery when the peripheral blood showed few or no paras tes buch an examinate n is of enormous value in differentiating a malarial

paroxysm from puerperal sepsis Rat Bute D s are - Following a rather long incubation period of from six to eight weeks during whi h time the bite has healed we have a rather sudden invasion with high fever 103 to 104 I' chill and at the me time inflammation of the site of the

Lite with lymphangitis and some elli g of tr butary glands

After two o three days of high fever we ba e a fall by crisis vith profuse persoira tion. The temperature emains normal fir a few days during which time the local s cling and inflammat on subside. The fiver again comes on I equently with an eruptio to later on d sappear as d reappear. At such times the fever course is 1 regular. There may be as may as x of the e febrile accessions.

Relaying Fere s -These fe ers ben the e are three or m re relapses can perhaps

be more easily diagnosed from the temp rature chart alone than is the case with any other disease ex enting malar. Hey is how, a tertian or quartan periodicity. With an abrupt r se of temperature which emains elevated for form three to seven days and drops by crisis to normal to be followed by approximately a week of normal tempera ture with two o three repetitions of the fever and appretic intervals we have an extremely characteristic temperature chart Unlik malana and yellow fever the onset is apt to be towards evening rather than

in the e rly afte noon The spleen s apt to be enlarged dure g the pyrexia and less so when the temper ture is normal. The spinochaetes are to be searched f r while fever is present as they disappear f om the peripheral circulation during the appretic intervals

of prime importance in diagnosis (2) Those in which the character of the lever gives but little assistance in diagnosis

DISEASES WITH SUDDEN ONSET AND TERMINATING BY CRISIS

Flackwater Free —The onset is usually quite sudden with a rather severe thall and marked lumbar pain. The temperature russ rapidly about 10.4 F and may fall us a few hours to a point but little above comma accompanied by profuse avening. The fall in temperature is not followed by a freding of improvement. On the other hand there may be a fewer course of remaitent or even continuous type. That which is most characteristic and which in the majority of cases enables the patient to make his own diagnosis is the topsace of other to poster of other than the majority of the state of the majority of the state of the majority of the state of t

The urnary sedument is samply granular défors there are no intact red cells. Itselfhatmonoplobururs and not a harmatinus. If there is any blood in the urne in pello fever it is in the form of a harmatura. The urne in both blackwater fever and yellon fever is highly albuminous. I so some cases the heading-blouwart access to result from quimin administration alone in which case there is not the high fever of typical black water fever. A distinguishing it from yellon fever heading a marked justices which comes on in a few hours or even with the first appearance of haemoplobinous instead of being delay glob until the third day as an yellon fever. Again the blackwater part oxysm is internetly prostrating at its markedly authority while the most of yellor fever oxysm is internetly prostrating. The enlarged entire splice most only somiting it as a prominent. Forture, with a "The enlarged enterlar splice most somiting is an early and severe feature of blackwater fever but not the black womit of yellow fever which does not cross en until affect the kind day.

The jaunchice of bilious remittent fever does not appear before the second day and

the unne shows bile moments instead of haemorlobin

Drague—In this disease the extremely sudden onset with a fever must profit to one of For more and remaining cleared for three or five days to fall by crust to normal and after an apprecial period of one or two days to be succeeded by a second febric account gives a free chart which is quite characteristic—the suddle back chart. The typical dengue explicin does not appear until towards the end of the primary fever or about the commencement of the secondary one. Intense postobutal sorreries is a striking feature in dengue. The comparative shonness of the pulse may be noted in dengue as well as in yellow fever. Levicopean, and not homophonicaler percentage.

reduction are rather characteristic Malaria Benign Tertian and Quartan -The presence of a fever of tertian or quartan periodicaty is absolutely characteristic of malaria. In rare cases however of meningo coccus sepsis without cerebral localization ne may have a tertian or even quartan periodicity Such cases are apt to show petechast spots and blood cultures give the is the result of the introduction by infected mosquitoes on successive days of two generations of malarial parasites in benign tertian or of three generations in quartan malaria a quotidian periodicity may abtain. Such a type of fever is observed in tuberculosis liver abscess and various pyogenic infections. The rise of temperature in benign tertian and quartan malaina takes place in about one half the cases somewhat early in the day while the daily rise in tuberculosis septic conditions and liver abscess is more apt to occur in the evening the evening rise being almost the rule in such diseases Hectic fevers generally abow a less distinct cycle of chilf hot stage and sweating than do the benign malarial paroxysms. At the same time the enlarged spleen presence of parasites in the peripheral circulation and response to quinine are diagnostic points in malaria which must always be thought of When quinne administration has caused the parasites to be temporarily absent from the blood the increase of large mononuclears is very suggestive

Mals to Multipoint Tertian —While being a malarial infections are more common in temperate climates malignant tertian is the one which usually prevail in the tropical flue outset in malignant tertian as table residence so that the case may be suspected as one of typhoid fever. At the same time the first parazyram is ant to them a tertian periodicity while subsequent ones by only reunting and not showing an intermit

An asson hing fact is that so severe and prolo ged a fever should give such a slight mortality (which in some seen: of cases has been only 2°). Occasionally a case shows a high continued or remutent fever and aggravated symptoms going into a typhoid state. Such case may be fatal. There is an increase in that leucocytes.

The wave course of the fever with afternile intervals and increasing anaemia is suggestive of kala again particularly when there is a greater enlargement of the spleen than is usu 1 in the disease. Ordinarily the spleen chalagement about corresponds to that of typhoid fever but at times it may be so much enlarged as to suggest the solence.

tumor of kala azar

Orosa Fer r—This lever is regarded as the first stage of vertuge; peruvana which is characterized by a severe amenia and mission of the red cells with Barbondie is all joints. With pairs of arious joints and hones the e is a gradual rise of tem per turn with a later a few days reaches 190 to 104 F and fends to become remittent or co timuous. There is a resu risable and excessive destruction of the red cells which may fall to a mail to releas per comm. The lever after about three neeks begins to fall by lysis. Enlargem int of liver spicen and lymphatic glinds are common. Pagn over the lones especially the sterium is as d to be often very severe. In the cases which reco er a vertucous eruption (the vertuga stage) usually follows.

Types remeats: Afr. on — The fewer of teyps nos mass ats markedly cregular and may exant matter as whosh preventing them from carrying or their duties as porter. The onset is on the whole, and/our. In this first stage of trypanoisonass or trypanoisone fewer when trypanoisoners of trypanoisone fewer when trypanoisoners are found only in the glands and perspical circulation what may probably be considered as leading pe that ties of the fewer are the great deally oscillations a normal moral or temperature to an specceeded by an eventine man.

up to roz F or to4 F

While the febrile course is usual in Europeans it is often absent in natives. With them the febr is manifestations are noted in the sleep g sickness stage. Again a very table low tension pulse is present whether the temperature be low or high. These febrile access one are followed by anyrea at inter als.

Extremely important m diagnosis are the glandular enlargements of which those of the upper posterior cervical transfer are the most characteristic (Winterbottom's sign)

Gland juice is more apt to contain trypanosomes than the film from the blood Deep hyperaesthesia is also a very cha acteristic symptom (Kér ndel s sign)

When the trypanosomers a foo dt the cerebroop all fluid the di ase ha reached the strond stage of trypanosomers or that of sleeping suchness. That i substrat in by a tremor of the tongue and mental symptoms of g eat ap thy and lattless ses. An irregular fever a present at times during the course of this stage of sleeping suchness but I wad dt in end of the diese g the temperature tends to be substrain! Progressive when the content of the temperature tends to be substrain! To gressive the substrain and the temperature tends to be substrain! To gressive the substrain and the temperature tends to be substrained.

Typino omics: South Ame 1000—The disease begins acutely in young children with an ite of it remitted fever. The parasities are not apt to be dought except dump the te or. The lymphatic glands become a nollen. With repe ted accessions of fever followed by apprecial intervisit the child be comes weaker and no reasoname. The sphen is enlarged. This if fect is may be very fatal for children. In adults the disease these than the content of the first feet is assumed to the content of the first disease the content stope. The disease has in come instances been as cauted with

invol ement of the thy old and symptoms of myzoed ma

T 1 upons his—The due resets, about a week after the bite of the Kedam muts with headache this and feer of about on F. The α sual bog pure critical improbabilities pland groups which will be found to draw the area on which is located a small necessive the size of the hist of the mut. The temperar is commons to two during the next two or the α -by to α - α - α - β I and remains an a high continuous feer for about a Neck when an emption of irregular dayly muches appears first on the fare and later on these terrenuities and tunk. About the tenth day the feer began to go down by 95 and the eruph is fall α . If yether on the comparison of the comparative ty marked

In tick fever numerous relapses are frequent in the I uropean (or Caucasian) and less common in the native

Lellou Ferer - With a sudden onset and rapidly rising fever which often occurs in the early morning hours in a patient who has gone to bed feeling well there is a mark edly congested face and neck with injected conjunctivae and intense headache and backache The fever tends to remain elevated for about three days after which there may be noted a fall in temperature or even an intermission. This which has been termed the period of calm is often slight and of short duration. About this time the joundice and haemorrhages show themselves and the temperature tends again to rise although less marked than with the otheric fever of the first two of three days Of great importance is the fact that the pulse rate falls with a maintained temperature or does not increase in rate as the temperature rises (Faget a sign) \ very slow pulse is quite characteristic of vellow fever after the third day

Important in the diagnosis of yellow fever from bilous remittent fever and black water fever is the absence of splenic enlargement in the former. In particular must it be remembered that joundice does not show itself in yellow lever until about the third

day following which we may have bleeding from the gums and black vomit

Melaena and haematuria may also be noted. The presence of a marked albuminura is one of the leading characteristics of yellow fever

DISEASES WITH GRADUAL DASET AND TERMINATING BY LYEIS

Add a ar -This disease has a peculiarly insidious onset because with a fairly high remittent fever it may cause but slight feeling of fliness in the patient. Rogers insuts upon the importance of taking the temperature every four hours so that one may note the fact of there being two distinct rises in the twenty four hours instead of the single evening rise of typhoid fever

At first it may be confused with malaria as well as typhoid. The spleen becomes greatly enlarged by the third or fourth month and later on we also have enlargement of the liver Periods of lever and apprexia occur arregularly and over a period of months of even longer than a year. There is a marked leucopenia and the presence of Leith manus often in large numbers in the pure from spleen or liver puncture furnishes a certain diagnosis

Li er thecess -In the so-called pre suppurative stage of amoebic hepatitis the only symptom may be an irregular remutent fever of moderate degree. This and a leucocy tosis may be the only points noted. In fully developed liver abscess we have a painful liver which is enlarged upward often with pain referred to the right shoulder and a crepitation at the base of the right lung. The fever is distinctly heetic in type with an evening rise and associated with profuse sweatings. The evening rise of temperature does not usually tend to exceed too I and apprexist intervals are frequently observed in the fever chart. It must be remembered that liver abscess has been found at autopsy where fever had not been noted. A sensation of chilliness often accompanies the evening rise of temperature

Malto Ferer (Undulant Fever)-In this disease in which the wave like febrile periods during every three or four weeks are so characteristic as to give it the name of lebus undulans there is a very insidious onset. For a week or ten days the temper ature climbs up stepladder like and then descends in like manner to be followed by a fev day's of apyrexia with succeeding similar relapses. The case might suggest an attack of

typhoid with relapses

The course of the disease is attended by rather marked anaemia and physical and mental depression. Very characteristic are the fleeting joint pains which involve chiefly the knees hip ankle and shoulder joints. There are pain and some swelling but without redness Acuralgic pains are also common There is often a bronchitis which when associated with the rather common night so eats of the disease is suggestive of phthisis The cardiac muscle seems to be especially hable to the touc effects of the disease so that a weak heart and intermittent pulse are often noted. It has a very protracted course of on the average about four months

alcoholic intoxication and the early cardiac involvement with very weak and irregular pulse may suggest plague even before the buboes appear. Films and cultures from

the buboes will furnish a definite diagnosis In plague pneumonia there is nothing characteristic about the rather continuous fe er which sets in suddenly and continues elevated until deatl which generally occurs about the third or fourth day The marked mental savolvement the extreme illn ss of

the p tient with but shight physical signs of the in olvement of the lungs should make one suspect a plague pneumoma urding an epidemic. The ahundant rather watery sputum which later always becomes sanguineous gives us a d gnos s by reason of its being loaded with hipolar stained plague bacilli. This material m y he rubbed on the shaven abdomen of a guinea pig to make the di gnosis absolutely sure the animal succumbing usu lly within three days to plague infection

In septicaemic plague if such he considered a distinct type there is very little that is ma ifest except a fever in a profoundly lige son The powers of resistanc may be so overwhelmed that the temperature response is slight and the chart may not show temperature records aho e roo F or 101 F Blood cultures furn h the diagnosis in sepucaemic plague but in severe infectio a the plague bacillus sometimes m y be seen a microscopical preparations of the blood

Schules migny -- In the vesical type of the disc so we may have as a complication a pyelitis which could give rise to febrile ma ilestate as In Japanese schistosomiasis the disease may set n with fe er a du ticaria B fore this e mb ation of symptoms was recognized as belonging to schi tosomias sit was sometimes designated urticarial

So fled Fever of the Ro by Mo intains - In sp tted fever of the Rocky Mountains

the fever elimbs up gradually for a week to reach its maximum and falls by lysis Trench Fever - Cases of v rying types of feve some charts sugge tive of dengue ones but generally with repeated relapses occur a treach fe er

In I largemia there is a pregular fever cou se I rather apid onset extending over two or three weeks. There is we y little evidence of toxacmia. Convalencence is

tedious

Typhe d fever and the sergirch id feet one are far from uncommon in the tropies and may sometimes present clinical cour es at variance with those obseived in temper ate clim tes. The temperature charts to such cases are egular and atypical. It must be remembered that paratyphoid infections may show marked gastro testi al symp toms and that the rose r sh of s ch cases tends t be far more p ofuse than that of typhoid.

I gas -While fever of a more or less gregular type frequently occurs at the onset of both primary and secondary stages espect by just before the secondary general eruption yet the course of yaws as t runs o er mooths or years is alchrile

DISEASES WITH SUNDIMAL TEMPERATURES.

There are certain diseases in which marked lowers g of the temperature may be a feat re of some stage. The aig d stage of cholera is thit which goes to cholera the picture of a livi g death with the cada end features and scy breath. Again in the cholerate type of algod permitto a mularia we may ha e a subnorm I tempe ture

In se ere infections of bacillary dysentery we my ha e cases shoting extreme toracmia with aigid mamie tatsons and a subnormal temperature. During the last stag s of sleep; g sickne s a lowering of the temper ture is fai ly consta t In heat prostration the temperature tend to be a baormal Clinically this condition with its pale clammy skin is just the opposite of heat str ke with its tu gid countenance a d hyperpyrexis. In the Indian type of rel psing fev r we m y ha e a fall to sub normal temperatures at the time of the crisis of the first paroxysm often attended with manifestations of collapse Sprue cases tend to run a subnorm I temperature during the terminal period

NONFEBRILE DISEASES

Among the nonf brile diseases we may note the following Benheri aprile pellagra ch lera leprosy amochic dysentery bookw rm disease filanasis bilhargiasis endemic 1670 APPENDEX

There may be a striking chinical similarity to tsuisugamushi. Rocky Vio ntain spotted lever and typhus lever. At present we recognize that all these and tabardilo

or Mexican typhus are forms of Rickettsial infection

Tophus Feter—While the classical temperature chart is usually described as one with a rapid new reaching the measurement of on or to, by the second day with a fastigium of twelve to fourteen days followed by a critical fail; by temmy cases observed in the Balkans show a fairly gradual once with a fail by justs. A stupporce condition with about the fifth day a rash first appearing about abdomes and flanks to soon become petechnal are important in diagnosis. The res is a leucocytosis with marked and staning of the granules of the polymorphomiclars.

DISEASES IN WHICH FEVER IS AT IMPORTANT FRATURE BUT GIVES LITTLE ASS STA CE IN DIAGNO IS

Ancylasiomians —The occasional reports of fever being present have been perhaps connected with bacterial infection at the site of attachment of the hookworm in the intestinal well.

Bacillary Dysentery —The onset may be quite sudden and the temperature me to soa? For roy F. There is and to be some evidence of locas may as shown by behaded slight tightness and gastere disturbance. The dysentent stool is of a reddisk much purulent appearance and Decked or streaked with blood rather than showing the uniformly brownsho or greening belatinous material of smoche dysentery. In very service bacillary dy entery algodity may develop with a cold claimay skim remanding one of cholers. At a work times the temperature is subsorting!

Epidemic jaundice shows an eregular pyrexia of from 102 to 103 F with jaundice

about the second or third day

Heat Stroke—The onset may be as sudden as in apoplery although there are usually prodromate of distincts and headsche. The patient often is uncon cours with dry burning skin labored or steetorous herathing and a temperature of from to to it! F The hopesprenal malarial paroxism often presents much in common with heat stroke.

Istatival Parasitis —There are many conditions which seem to be productive of intrine states as evidenced by the disapperance of the fever upon removing useful care. Thus patients presenting abdominal distress and a fever of varying type may be completely relieved of all symptoms upon executing the larvae of various first following pargation. This condition is designated intestinal mynams. Abdominal pains and fever may also be caused by various belimitats formerly considered monosymptom producing as has been noted in heavy stears; infections. The larvae in unindering though the large expallairs sim younce po income.

Molarial Co brus — Attacks of an irregular type of fever are frequently noted in the malarial cachectic especially arising after some exposure to diampness or ching to alcoholic excresses of to excessive fatigue. Cases are also met with in the tropics particularly among natives where there is no fever and yet profound anarma and an ague-cake splace. This absence of fever might suggest delerance or evidence of immunity to malaria in the native with such anaema, and large spleen. Such excessions in they flowed and case are reservoirs of virus for mosquitus infection.

Malara Leten —Fol owing irratioent or even when quantic has not been exhibited access of malara even though a cure has not been effected often cease to show chineal asymptoms or positive blood findings until a relapse develops. As noted elsewhere these relapses; is which the febrile manifestations are preminent often follow exposure to tropical suitably wetting surprised operation etc. Besides such finals manifestations we may have numerous symptoms that exhibit periodicity arising in the course of nonfebrile latter unlains.

Flague—The fever rapidly rares so that the maximum temperature of tay F or more may be attained on the first day of the desease. In general the type of fever more may be at a rather ranked emission about the third day following which the fever usually again goes up with the appearance of the glandular involvement (hubone) played. In fath cases the temperature may new rapidly just prot to draft. The

South American Trepassessman :—Acute type (4) Usually in children (2) Marked juffiness of ince (3) Enlargement of lymph ghands and spicen (3) High fe er with morrang remusion. Diagnosis should be confirmed by laboratory procedures if possible Such exam attons should unclode microcoopical examination of the blood for trypanosomes and the inoculation of guines page with the blood. A complement fixation test has been employed: In the chronic form symptoms of myrodenas and enlarged hypord have been reported. These symptoms may be due to indicate the chronic form of trypanosoms and enlarged thyroid have been reported.

Tsutsugamushs.—See typhua

Tularatum.—Tularatum as a plague like duesse occurring in man follon ing contact with rability or other redents. Characteristic of tularatem as ne (i) Ilstory of contact with rabbits (i) Local lets on on hands head or eye: (a) I ollowed later by sudden onest of fever and protection (a) Swelting and at times supported to of lymph planded draining untial lesson. Asyraal inoculation and agglutination tests necessary for diag. in 35. One on tummute should not handle asy ammuni a coultated with P ularatum without extreme custom and secaning of rubber gloves. It is apparently not transmitted from man to m is

Typhus Fever —This louse borne disease is characterized by a more rapid rise of fever and a more supposes that has it true of typhoid elever in this which it as a confused in the early years of the roth section. The eviption appears from the fourth to seventh agy and unlike somewhat I om the eviptions executed the section of the secti

Where "Sha uters which vary greatly a tiol gr and symptomatology have been found in I parts of the troppe." One type has been dearned in Jornat of the troppe. One type has been dearned as from the part of the troppe data of the part of the troppe and the part of the troppe and the part of the troppe and the part of the troppe and the part of the part o

the ul er is charact ristic of rat bite fever or tularactura

Let y w-in nerve inproxy we often he we post a time where of the feet and hands Solve cell an e is a "The uke or of a chie cell amenua is multiple punched out indicated occurs in the shin and is generally secondarily infected. In some cases there are pains in the bine and op ints and steepers is may be demonstrated by Narys. Gene aligh indular all gens at negative hashs and low blood pressure are found. The find not of the characteria called shaped red bind cells (especially in found) that the contraction of the characteria called shaped and the cell shaped constitutional is comply presented to support a sharested by orther sees as a down in a mendel in character of c.

Lies the Fa - Syphil's Delhi boil gla de's and blastamycosis should be particularly to side ed

Uke z the Mo ti -Syph lis p llagra mercury p isoning scurvy sprue per nicious anaemia. Vi cents a gina pyorthoea alveolaris bould be co sidered.

Undulant Fe er "The most sign ficant finding in undulant fever is the characteristic temperature waves. Following the in tial pent of fever there is a thort affende interval of a day or so to be succeeded by a see and third or many f these undulating waves thereby g v ng to the cound to it manne. Hone er many cases do not show that type of fe e. The aymptons which may give the g catest a d to early diagn as

haemoptysis or paragonomiasis liver fluke thisease malarial cachexia yaws verriga oriental sore and ulcerating granuloma of the pudends as well as the various tropica skin diseases

One should always keep in mind the fact that a latent malaria often gives way to frank malanal manifestations when some intercurrent disease still further reduces the body resistance. This is not infrequently the explanation of a febrile onset in the course of a disease typically afebrile. In the tropics if a fever chart does not show a characteristic periodicity one can often obtain indications of periodicity even in a con tinued or remittent fever course by the greater elevation of temperature every third day (tertian periodicity) Another disease which often flares up following conditions which lower vitality and gives rise to leverand manifestations of to aemia as tuberculosis a disease as common in the tropics as elsewhere. Then too one must always keep in mind febrile marriestations not uncommonly marking syphilis. This tried of discrees malaria tuberculosis and syphilis must always be thought of as well as septic coa ditions when fever is present in a disease typically afebrile. There are certain exceptions in the above list which may be here noted

Amoebic Dysentery -- Unless complicated by bepatitis or some bacterial infection

of the amoebic lesions the disease progresses without fever

Besiders -- There has been considerable discussion as to a hether a disease with fever and a rash but otherwise resembling wet beribers is the same disease or a distinct disease entity. The fever in epidemic dropsy as at is called is rately over 101 F usually ranging from 90 to 101 and accompanying the dropsy

Cholera -- Instead of a lavorable stage of reaction there may set in a condition with low muttering delinum dry brown tongue and with an elevated temperature

the so-called typhoid state which is speedily fatal

Rarely a rise of 3 or 4 degrees which does not last more than forty eight hours

may be present in a stage of reaction going on to a favorable convalescence

It must be remembered that the rectal temperature in the majority of cases of

cholers may show elevation of temperature approximating too F while the azillary temperature may be as low as 95 F When there is a great difference between the rectal and axillary temperatures instead of the more common 4 or 5 degrees of a typical case of cholera the prognosis is bad. The temperature taken by mouth may be as low as So F Leprosy - I mong the prodromata of Seprosy along with epistams feeling of great

weakness somnolence and occasional sweats there may be recurning attacks of fever These are at times diagnosed as malarial manifestations. With the appearance of typical lesions the course is apt to be nonfebrale with the exception that febrile accessions

often accompany the early macular manifestations

Pellagro -While there may be slight variations from the normal yet the ordinary case of pellagra fails to show a distinct febrile course so much so that the appearance of fever in a case of pellagra suggests an unfavorable prognosis. In the so called typhoid pellagra an acute rapidly fatal form of the disease a high temperature curie may be obtained. As the same time this condition has been noted by Italian and German writers as being present in patients not showing any tise in temperature It is possible that the development of enteric fever in a pellagrin may at times be the explanation of the fever Sorne -- While sprue is certainly one of the most typical of alchnic diseases yet a

form of aprue is recognized which begins as an acute entero-colitis with fever. This must be most exceptional or only a comcidence as sprue is characterized by a very

insidious onset

Tetanus -History of wound one or two weeks previous stiffness of neck retraction of head Convulsions with rigidity between contractions opisthotonus locking of jaws Laboratory aids make culture from wound animal moculation

Trypanosomiasis - Diagnostic features to be looked for (1) Glandular enlargement of post cervical glands (See Winterbottom a sign) (2) Deep hyperaesthesia (See Kerandel's sign) (3) Lack of mental concentration drownness or sleepiness Patient tends to sleep all the time (5) Etythematous areas may be present Trypanosomes in gland juice spiral fluid or blood

There is no quick test for the disease in the early stages but as Duff (1941) points out the occurrence of cases with the foregoing syndrome in an endemic area often justifies the diagnosis and prompt application of local preventive measure

Findlay (1941) believes the only certain diagnosis should be based on examination of liver tissue in fatal cases by a competent pathologist mouse protection tests with the patient's serum both during fever and later during convalescence and isolation of virus

is pain to the sacro that region with sudden and painful swellings of joints accompanied by enlargement of the spicen with anaema and cardiac weakness. Blood culture and agglutination tests should be made to confirm the diagnosis

Urobimuria .- In conditions where there is a great destruction of red cells tests for urobilin are important. Picha considers the presence of urobilin as of importance in the diagnosis of latent malaria which is true provided other causes for red blood cell destruction are excluded. Blackwater fever cases usually show an intense urabili-

nuna Urobelinuma is also a sign of deficient functioning of the liver

Verruga -Under the name Carnon's disease or Oroya lever there is a lever associ ated with rapidly occurring anaemia and hone pains and the presence of Bartonella bacilliformis in the blood In the majority of the cases which recover a verrucous eruption appears upon the skin. Strong Tyzzer and Sellards established the etiology of the febrile stage while Noguchi and Battistins who first cultivated Bartonella becill former shouled it was also the cause of the verrucous stage of the disease as well and would produce the verrucous lesions in monkeys on inoculation. Townsend and Shannon have made studies of the puzzling endemiology of the disease which is restricted to endemic areas an I can be contracted only by being in such a region at night and after eliminating other blood sucking arthropods have incriminated two species of Philebotomus I territarum and P noguckis. These midges nere collected in the endemic area of Peru sent to New York and there after being emulsified were injected into the skin of thesis monkeys. The organism of verruga (or Oroya fever) was cultured from the blood of these monkeys See also work of Hertig p 1006

Vomiting -- In sellow fever vomiting of bile stained mucus occurs early Black

vomit if it appears never comes on before the fourth day Well a Disease -See infectious saundice

Winterbottom's Sign .- I'nlargement of the lymphatic glands especially those of the posterior cervical triangle in trypanosomiasis

Wrist Drap - 1 paralysis of the extensor muscles of the hand and fingers is found in alcoholic neuntis malaria leprous neuritis beribers poisoning from ariente lead and mercury. It may be due to trauma as in musculo spiral nerve injury or it may follow acute aniectious fevers. Unilateral wrist drop is generally indicative of inpury See neuntis

Yaws -In many instances it would require the discriminating mind of a Ionathan Hutchinson to differentiate yans from syphilis and in fact this greatest of diagnosticians said that if it were not syphilis it offered a very exact parallel. If we consider it as a modified form of innocent syphilis contracted in childhood with an environment of primitive culture and moist heat we can understand its almost evelusive limitation to the tropics and to primitive people. An extragenital initial lesion of papular to cond) iomatous character is followed in 3 or 4 weeks by a generalized eruption of similar lesions Lever joint and bone pairs especially extencepic are common Tertiary lesions similar to those of syphilis may occur even ancuryam and rerebral haemorrhage have been reported in a few instances. Leculiar tertiary manifestations are (i) Goundon with a subperiostitis and enlargement of the masal processes of the superior maxiliary bones (2) Gangosa a destructive obserating process involving natal and oral cavities (3) Junta articular nodes which are connective tissue tumours com monly located in relation to sounts

Yellow Fever -The main points to consider in the diagnosis are (1) Presence of vector and reservoir of infection (2) Severe cephalalgia and rachalgia (3) Albuminuma occurring on and or ard day (4) Epigastric tenderness (5) Lack of correlation between pulse and tem perature (see Faget's sign) (6) No clouding of intellect (7) Late appearance of jaundice (8) Tendency to haemorrhage especially from gums nose and intestines See Chapter \\III on yellow fever for differ ential diagnosis

tion of large doses of iron. Differentiate from chronic cost has morrhagic anaemia

chlorosis cancer hookworm anaemia Ansemia Permitious,--- High volume under and high color index Marked aniso evtosis macrocytosis poikilocytosis. Megaloblasts su severe untreated cases. Evi dences of haemolysis during progressive stages. Leucopenia with hypersegmented

neutrophiles Blood cholesterol reduced Achlorhydria after histamin Reticulocyte ens a follows administration of potent he er extract in severe cases Angemia Posthaemorrhagic Acute -Features of hypochromic apaemia present in moderate degree Laually reticulocyto is leucocytosis and increase in platelets

Normoblasts may appear after third day Anaemia Posthaemorrhagie Chronic - Features of hypochromic anaemia marked

Low color and saturat on under II whene a of recent ation variable. In late stage may show aplastic type of anaemia

Angemia Sickle Cell,-Seal fresh moist preparations and observe for 1 to 24 hours for sickled red cells (Rare in st med blms) Se ere cases show many normobl sts reticulocytosis leucocytosis increased pl telets. Look for macrophages containing red cells Roentgenograms of skull may sho cha ges I muted to negroes

Anaphylaxis,-See Hypersensitive ess

Ancylostomiasis.- Examine fa ces by concentration methods for characteristic ova (See p 1266) Examine blood for anaemia (hypochromic microcytic) and rosmophiha

Anguna, Streptococcal.- Vial. cultures on I office a scrum and blood agar plates Stain films with Löffler's methylene blue and Gram Differentiate from dichtheria and Vincent a angina

Anguna Vincent s. -- See Fuso-spirochaetosis

Anthrax - () Mahgnant sustule Examin mater I from pustule directly in stained films and hanging drop for large Gram positive non motile b cilli Culture on agar Inoculate a mouse o gus ea pg subcuta e usly Blood cultures rarely

positive (2) Woolsorters disease Framine sputum in a s milar way Asearis Infection -Examine facces for char eteristic ova Worms occasionally

found in facces or vomitus

Balantidium Infection,-Look f r la je m tile ciliates in facces

Banti a Disease - Moderate to severe anarma usually hypochromic in type Leucopenia Test fraculty of the red cells to exclude baemolytic paund ce Make van den Bergh test and determine icterus dex Test liver function Examine facere for occult blood

Blackwater Fever - Haemost binuria pink foam to urine test fitrate for haemo globin spectroscomeally and by benzidine or outhotolidine test. Malarial paras tes found in thick blood film a some eases Leucopenia M nocytosis Exami e blood serum for baetn globin and biliruhin (van den Bergh test) Donath Landsteiner test negati e

Blastomycos s.-Examine sputum pa or scraps ga from ma gins of ulcers in 10" KOII for spherical budding ve st cell with highly ref tile double-contoured walle M ke culture on glucose ag r plates

Botulism - Inject an a fusion of the su pect d food into a guinea pig. If p sitive animal des after bulbar and pap flary symptoms. Culture anaerobically on glucose agar Culture may be kept in a dark Il ce at room temperature

Brucellos: - Make bl od culture at onset of f bule paroxysm incubate in atmos phere of 10" CO Make cultu es fr m um e faeces and local foci in special cases Guinea pig inocul tion sometim s successful. After fifth day make agel to ation tests titer of - oo or over a diagnost c I 1 dermal test with vacci e Relative lymphocytos a ofte leucopenia Differentiate from typhoid fe er tuberculos a malarıa kala a ar Cerebrospinal Fever - See Meni gitis memprococcus

Cestode Infections,-Examine facces for ove which are not always present. If a segment is obtained pres between two glass slides and e amine the branchings of the uterus

Section II

LABORATORY PROCEDURES USEFUL IN DIAGNOSIS, INDEXED BY DISEASES

This index has been compiled to assist in the selection of laboratory procedures which are likely to be of value in the diagnosis of the disease instell particularly those which can not be recognized by their chirculficatures alone. Only those of major importance in the tropics are given. The statements in the noder apply to the average and many are subject to himitations or qualifications for which the text should be consulted. To be of value laboratory tests must be performed with such procuse that the probable technical error is well within the himits of the physiological variation. The results can be interpreted concectly only in conjunction with all the information available concerning the patient. This responsibility belongs to the clinician and should not be expected of or entirested to a laboratory technical.

Abscess of Liver Amorbio——spirate contents asoptically and culture on blood gar plates (no growth unless secondard) infected? Pur seconder nethody assert films usually show detection with few pur cells Amorbias found in fresh preparations usually only after drainage has been established. Examine faces for trophometer and extra Monociar entirophile (exceeding a cell followed loss). Rochtemogram

Abreess Language proteins bondy murdiest effectively the process being supported by the process by the process being supported by the process being supported by the process being supported by the process being supported by the process being supported by the process by the process being supported by the process by the

Abacess Tuberculous—If stained films of the pusses negative for pyogene organisms stain for said fast bacilli. Concentrate with alkali if necessary—Nake cultures and inoculate a gunna pig. Leucocyte count variable—Sedimentation rate meterated Andosis—If possible test CO, combining power of plasma. Alternatives Test CO, tennion of alt-soular at Tuberculate Test and the contractive first contractive and alternative first contractive first con

Determine tolerance for NaIICO, Look for ketone bodies in urine Test off of urine Ammonia in urine increased at expense of urea

Actionnycosis.—Look for yellow sulphor granules in pus or sputum Press out granules between slides and state by Gram's method. The central systemum is Gram possitive white perspheral clubs are Gram negative. Culture anaerobically

(See p sr8a)

Agranulocytoses (Malgrant Neutropense)—Lecopenus becoming retrees with desappearance of granulocytes. Red cells platelets casplation factors under some control of the platelets capplation factors with some separation of the platelets of the platelets cappeared to the platelets of the platelets

Allergy -See Hypersensitiveness

Amochiasis — Note gross and microscopic appearance of the stools (See pp. 505-500). Eximine facces for trophosustes and cynts. Way show monocytosis. Differentiate from bacillary dysentery and chromic foon specific) ulcerative collisis.

Anaerma Aplasbe. Qualitative changes in red cells slight. No signs of regeneration. Marked neutrophilic leucopema and thrombocytopema with purpura. Sternal

marrow shows few erythroblasts of myelocytes

Anaemis Haemolylic —Postuse indirect van den Bergh High icterus inder Uroblin increased in urine and faces - Reticulocytes usually increased Leucocytesis. In fullmant cases look for harmoglobumuna

Anaemus Hypochromuc—Cells very pale usually small Color index and satura toon index low Corpuscular volume usually low Icterus index normal or low Anaemus Idiopathic Hypochromuc—Largely lutated to momen 20 to 50 years old

Usual features of hypothrome anaemus marked Lencopens frequent Subscudiy or achierhydria usually even after histanin Teticulocyte crisis follows administra

Dysentery Bacillary -The sanguinolent mucu contains many pus cells and many phagocytic endothelial cells. Emulsity mucus in sterile b oth or salt solution and plate n Teague Endo or desoxycholate cu ate medium. Id ntuly organisms isolat d by agglutination with immune sera. Neutrophilic leucocytosis. After 7 to 10 days make agglutinati n tests Ethinococcus Disease - Examine fluid fr m cyst for booklets Foundphilia

Make complement fixation precipitin or cutane us tests with special antigen p 1478 | Poentgenograms

Elephantiasis -- See Filanasis

Enteritis Tuberculous -Stam smear f om faeces for acid fast bacilly There are often present in faeces acid i at ap re like bodies which should not be mixtaken for t bercle bacille. Tubercle bacille may be pres at a f eces when there is no involve ment of intestine (swallowed sputum parts ularly in children)

Eosmophilia -Look for ova of int stin I parasites in face a To k for evid nee of trichinosis bydatid disease filarias s artous skin di cases asthma and other allergic

reacti as and lessons of the hone marrow Favus. -Pl ce hair or portion of favus cup on a slide a desamine in of KOH f r

myeebum and spotes which are very a regular

Filariasis .- Examine blood (day and night) for lar se other in fresh most prepara tion or better in thick films stained by Giemsa (In elepha tissis larvae are often absent from blood) Asp; ate lymph varix or hydrocele and examine sediment for larvee Examine sediment of chylous urine or ascitic fluid Often cosin phil a Com plement fixation test omet mes p sit ve with special antigen

Flagellates Intestinal - Examine facces emulsified in salt solution for motile flagellates Emulsify s other po tion in Gram's solution to study flagella. Stain smear with Gremen's stain for enevated f rms which m y be co fused with Blasic

Cystis (5 e pp 463-470)

Fusospirochaetosis (Vincent's Angina and Stomatitis) -Stain films I'm terial from the depths of the les on with dil it early I fuchs; or Fontana's stain (The spirochaetes and fusiform hacilli are p c ent in la g numbers a few may be present in normal mouths) M ke cultures on Loffler's serum and blood agar to exclude diphtheris a d streptococcaf infe to a Lxamine blood to exclude leukaemia and agranul cytic angi a. There may be a marked lymphocytosis. E clude syphilis hy Wasserma n or Kabn test. In pulm pary inf cu as examine perferlly fresh sputum in sta ned films and dark field preparate as See Abcess of lung

Gas Cangrene - (I fections a e usu By mated important I hisms are Cl welrk a

Cl ordemet as and Cl ordemetes motions Pr case ident fication difficult but important because of serum t eatment) Make ha ging drop and stain amears from ex date by Cram and for capsules (All are Gram p sat ve Cl welches is encapsulated and non motile the other two are motile and non-encapsulated) Make apacrobic cultures in htmus milk and glucose ager tubes (CI to lokus causes gas formation and disruption of the tube over night } Blood cultures (nacrobic) may be positive

(landers - Smears from pus sh w characterist c Gram negat ve bacilli parallel braded rods. Culture on seid glycer n agar and potato. Inoculate male guinea pig intrapentoneally (See p 73) Complement fixation and a glutination tests may be posit e (Malle n tests in animals) Gonococcus Infection - Gram s star of smear f om urethra cervical canal or eve

shows intracellular Gram pegative d plococci. Make culture. Complement fixation

test useful in chronic infections

Granuloma Venereum -Stan ser pi gs fr m ulcers f r Donovan bodies in large mononuclear cells (Wright or Gremsa)

Haemsturia. - Examine sediment for red cells Apply orthotolidine test Haematuria Egyptian - (S e Sch stosomissis)

Ha moglobinutia.-Exams e contribuged sediment for intact red cells cells may be found with much debris. Test filtered urine f r baemogl bin spectro scop cally and by benzidine r orthotolidine test

Hookworm Infection. (See Ancylost miasis.)

Chancrosd-Ducrey a Bacillus - Examine smears for short Gram negative cocco bacilly occurring in chains. Culture material aspirated from bubo in sterile clotted human or rabbit blood which has been mactivated at 56 C for 30 minutes. Syringe and media must be warm

Chlorosis -- Hypochromic microcytic anaemia sometimes severe in adolescent Low saturation index Gastric acidity normal Differentiate from chronic

posthaemorrhagic anaemia

Cholera .- Smears from flecks in rice water stools show many vibros with fish in stream arrangement Culture on Dieudonne plates. If sparse use conchinent method Identify organism with cholers immune serum. After fourth day test serum for agglutinins. Intense dehydration with high blood counts high plasma proteins and high specific gravity of blood. Anuna with high non protein blood nitrogen Acidosis from loss of base Depletion of chlorides Differentiate from food poisonings assenic or antimony poisoning bacillary dysentery algid permitious malana

Chyluma -Centraluge unne and examine for filarial larvae Examine blood at night for filarial larvae (not always present). Usine contains many highly refractile

fat globules soluble in ether Curhosis of Liver -Do Wassermann or Kahn test Icterus index and van den Test unne for bilirubin and urobilin Make tests of liver function and Takata Ara test or determine A/G ratio Examine facces for occult blood Late cases

may show macrocy tie annemia (See also Banti a disease Layer pecrosis of) Coccidioidal Granuloms -- Txamine pus or scrapings from ulcers in 10" KOII for large yeast like cells which may contain endospores Biopsy if necessary Culture on glucose agar. Make blood culture. Esclude tuberculous by repeated stains

cultures and guines pig inoculation (See p. 2153)

Colitis Chronic Ulcerative - Examine faeces or preferably scrapings from ulcen (protoscope) for pus blood mucus Exclude amorbic and bacillary dysentery by fresh narm stage preparations cultures and agglutination tests \eutrophilic leuco cytosis often secondary anaemia increased sedimentation rate. Reentgenograms

Cours Mucous (Speeche Colitis) - Examine facces for mucus in large masses containing enithelial cells often cosmonliles no pus cells no blood. No leucocytosis

normal sedimentation rate. Roentgenograms

Come -- I xamine urine for sugar ketone bodies albumin casts blood Examine blood for sugar CO combining power non protein nitrogen or uren and in special cases for alcohol and CO Consider possibility of other poisons Remove spinal fluid cautiously examine especially for pressure presence of red cells and nanthochromis (subarachnoid haemorrhage) Make leucocyte count and blood culture if febrile

Conjunctivitis.—Stain amout by Gram's method and with dilute carbol fuchsing Culture secretion on blood agar and plain agar (See p. 1681)

Dengue - Acutrophilic leucopenia

Dermatomycoses. - Examine scrapings from skin in 10" KOH for fungi Culture

on Sabourand agar

Diphtheria. - Nake amears and cultures on Loffler's serum or whole egg medium Stain by Gram's and Löffler's or Senser's method Look for parallel rods containing polar granules. In special cases isolate on tellurite blood agar and inject guinea pig with broth culture filtrate as test for virulence. Make Schick test on contacts. Dif ferentiate from streptococcus and Vincent's infections

Diphyllobothrium Infection. - Operculated ove in facces If segments are obtained press one between two glass slides and look for characteristic rosette shaped uterus

Macrocytic attaemia occurs in rare instances

Descunculus Infection - Moisten blister or ulcer with a few cubic centimeters of

water Examine fluid excreted by worm for striated larvae

Drzentery Amoebic.--Examine mucus from fresh warm stool (warm stage) for amoebae actively putting forth blade like pseudopodia. If necessary pass rectal tube give saline purge or scrape base of ulcer through a proctoscope Pathogenic anisebas often contain red cells Examine faeces for four nucleated cysts Smear of faeces shows granular detritus often Charcot Leyden crystels no pus cella Monocytosis No cosmophiba

with leucin and tyros n erystals usually only after concentration. High non protein nitrogen with los urea in blood. Hypoglycaemia. Decreased fibring n. Prolonged enagulation time. Decreased edimentation rate. Acido is may occur

Lymphograpuloma Ingumale -Free test

Madura Foot,-Discharge contains fish for granules which show mycel am and

peripheral club like structures

Malaria - Examine thin films stained by Giem a or Wright's stain. If negative stain thick films. To identify in object as a malar all parasite in stained films one sh uld be able to make out at least two f three characters (1) ch omatin (2) bluish or greenish cytoplasm and (3) pigment. Crescents are diagnostic for malignant tertian equatorial banding lo quartan Marked are ulanty of outline of para ite and the presence of Schuffner's (reddish) dot in c toplasm of red cells suggests benign tertian Leucorenia with monocytoms Leucocytosis during the paroxysms. Anae mia of haemolytic type. I lasma globulm 1 eas 1 about 15 how posit ve Wassermann rea tion during leb ile pe 1 ds. Was try provocative procedur s. I have try provocative procedur s. I need to be seen the seen and t

urine by Tanret s Bing s or Andre s tests Meningius Meningococcus - Blood cultures often po itive in early cases and in simple memngococcaemia Spinal fluid purule t under hi li pressure Culture s im d tely on warm blood agar Fxamine stained film I s Gram negati e i tracellular or extracellular diplococci. Flu d gives a pre initin reaction with polyvalent antimeningococcus serum. If cloudy fluid is obtained t as forme ly recommended to give serum immed ately. However serum tr atment is now g nerally not rec mmended Circular 81 (Dee 5 940) sued from the Office of the Surgeon General of the U S Army recommends sulfanilamide o ally as the drug of choice \eutrophilic leucocyto Differentiate from a ptic meningiti tuberculosi meningitis poliomyelitis encephalitis bei um lymphocytic chonomeningitis. Detect carriers by cultures from

post nor assophers at Mercury Poisoning-Examine urine or gastric cont nis for mercury urne for olume (oligura) albumin ca ts renal pithelium Determine blood n n or tem nitrogen o uses and creating if severe test for acidosis Renal function

tests show impairment Myroedema - B s f metabolic rate reta d d (to -40") Blood sho is high cholesterol low glucose Lov flat glu o e t lerance curve Anaemia either macro

ytic or hypochronic microcytic in type. Often lymphocytosis

Nephritis Acute and Chronic - F amine urine especially for albumi 1 casts blood and pus cells. The presence of blood and red cell casts indicates an acute piace In acute cases lo k for streptococcal th o t infection Test r pal function Det r mine blood non prote n n tror n or urea and if high or atinin or phosphorus. If imp s ed dete mine blo d'chloride or ba s and test for acido is Anaemia common in advanced stages (See Nephrous)

Nephrosis"- Nephrobo Stage of Glomerular Nephrobs - Examine unne

Oligura high fixed so fo gravity marked albuminuma many casts epithelial cells with doubly efractile fat droplets pus ells but fen o no red cells. Chloride excretion reduced I http:// recretion.normal Blood cholesterol very high pla ma albumin reduced A/G r to invert d Chlo ides may be high No itrogen retention Congo red test no it se Sed m niation rate much accelerated Basal metabolic rate retarded. Ansemia c mmon. Lo k for. d nee of inte current infections

Ocular Infection -11 is now ecogn zed as adv sable to make an examination for the In unococers before performing operations of the eye as serious results may follow if the Pneu oc c u be present. It is the rg mism to the frequently responsible for infect on after cataract on rat o s. It s f equently f und in dacry ocysistis and in

the ase of traumatism may bring ab ut pan phthalmitis

The Pne mot c us a a farly ommon can e of se paganou corneal ulcerations for which crive treatm nt is nece 5 sy Corne l'ulcerations a e not apt to appear even with a pneumococcal cong n to it s u le s there be an inju y of the epithelium

The pyocyan us bacillus may cu s se ere pu ulent kerat tis as well as conjunc tivitis. The pyocyaneus toxin appea a to be a factor in the production of the les ons observed

Hypersensitiveness.—Test for hypersensitiveness to pollens animal hair foods et by cutaneous tests or interactianeous injections of suitable stratels or in pecual cases by patch tests. To determine if a patient is sensitive and earning inject into dermally or cor of a ra- of distons of the serum. If he is sensitive an untrainal what will develop within 100 rt 5 minutes. A drop of serum in - of olision may be instilled unto the conjunctiva (see p. 150). Sensitization to quintie may be shown in occasional cases by the production of a wheal shortly after 10% solition of a quintie salls usplied on a scratch.

Infectious Mononucleosis—Leucocytosis with high lymphocytosis (up to 90") Vany pathological lymphocytes (Vay not appear until several days after onset and may persist for months) After 5 to 10 days test serum for heterophile agglutions for sheep red cells

Influenza.—Leucopenia and granulocytopenia Frequent secondary infections particularly of the respiratory tract

Intestinal Parasites -Lxamine faeces for ova

Jaundice Catarrhal (Hepatitis) — Test urine for bile High interus index Positive van den Bergh reaction type variable. Pacees show diminished or absent bile pig ments increased fat Test liver function. Differentiate from infectious jaundice arsenic and phosphorus poisoning types of obstructive jaundice.

Jaundice Familial Haemolytic—Usual features of haemolytic anaemia marked Fengility of ted cells in hypotonic salt solution increased Reticulocytes much increased Red cells have normal volume but diameter is small (more globular than

normal) Look for evidences of cholelithiasis

Jaundee Infectious (Wed a Disease) — I xamine blood (first 3 days) for lepto put in stanned films or dark feld preparations (sparse). Preferably, inoculate a guinea pie with r to 3 cc of blood intraperationally and at autopay examine the liver for leptospara. Blood cultures may be made in Picther's medium and michated at 3 g to 3 of After the twelfth day examine urine sediment for leptospara by some a and guinea pie more in the first first for the sediment of the sediment o

positive addiesion phenomenon or aggluination or profettion lett. L'eucocytosis Kala Azar — Culture lidood on NNn medium. Search for Euchimanna within the leucocytes and monocytes in blood films either directly or from the buffy coat in which the leucocytes are concentrated after centraligalization of citarted blood. If not found examine material obtained by splens, puncture or more salely by puncture of the liver of strain lone marriow. (They are found occasionally in extend buffer glands or apprated gland junce). Blood globulin markedly increased gland and antimony tests. I latted leucopensa with relative monocytosis. Differentiate from brucellosis. typhoid and paratyphoid fever. Bantia s disease: chronic malama leukaemus.

Lead Poisoning —If exposure is recent examine unne for lead Dhod shows early increase in reticulocytes and many stippled cells later anaemia in acute cases swere and harmolytic in type —Iragility of red cells decreased —Diten neutroph is lexco-cytosis. —Ixamine unne for albumin and casts. —In late cases test renal function.

Leishmaniasis -See Kala azar and Oriental sore

Leprosy—Diagnons depends upon demon trating leprosy bacilli is unears stained by Zehl Neslon method. Decolorize lightly with 50% aqueous [15:0]. Morpholosy characteristic Usually abundant in material from granulumata or scraping from mose I fin o lesions are evident examine scraping from and mucous membrane or skin chips from earl lobe. Examine blood during lebrile periods make thick films deharmigholism e and stain as above or stain films from sediment after digestion with alkali. Cultures and animal moculation is cless except to exclude tuberculosis. Wassermann reaction positive in about 60° of the casts.

Leukacmus Chronic Myelogenous—Total leukocyte count usually from 200 000 to 500 000 with a large proportion of myelocytes. In terminal stage many mye o blasts. Progressive anaemia. Normoblasts nearly always present often numerous Platelets increased. Pasal metabolic rate increased. Blood unclacid high

Liver Necrosis of —Test hver function Bihrubin in the blood is increased Urobilinuma present In advanced stages shows Increase in ratio of NH /urea in unne De 10dex may eause an obstinate blephantis

For zerophihalmia and n ght blind est due to deficiency of Vitamin \ see p 1030 Ordens. - Examine urine for evidence of nephritis Test senal function Deter

mine plasma proteins A/G ratio blood chlorides

Onchocerciasis - Aspirate fluid from a nodule and look for motile larvae in fresh preparation or stain by Giemsa. If nevative excise a nodule and look for adult worm or (very numerous) larvae Clip off a bit of akin or conjunctiva moj ten in a few drops of salt solution and look for larvae (Larvae are not present m the blood) Comple ment first on test usually unsatisfactory

Ophthalmia Neonatorum,- (See Gonococcus Infections)

Oriental Sore -- Examine scrapings from base of ulcer for Leishman Donovan bodie Stain with Wright or G emsa. Prefe ably obtain material by aspiration by puncture near edge of ulcer. If bacterial contami ation c n be avoided culture on NNN medium. In espundia obtain material also from adjacent lymph nodes by pimeture Oroya Fever - Acute rapidly developing ba molytic annemia. Rod like organism

Bartonella bacill form in red cells Paragonimiasis.-Examine fresh sputum for h ht yellow operculated o a averag

ing on by few. Also for our blood elastic fibres. Exclude tuberculous Parstyphoid Fever - Examine as for typhoid feve

Piedra.-Examine bairs for small gritty masses which consist of spores arranged

like mosaics about bairs

Plague-Bubonic Type -Examine material obtained by gland puncture for P pesies Stain smears culture and moculate a guines pig to identify Pacumenic Iyee Examine the thin watery blood timed sputum in the same way. To obtain pure culture in culate on unbroken skin of animal S frica m 130 Make blood culture P pe tra may be sufficiently numerous to b found in blood films Leucoes tosis Dif ferentiate f om tularserus

Purpura Haemorrhagica (Thrombocytopenic) -Platelet count reduced Bleeding time prolonged. Clot retraction impaired. Tourniquet test positive. Cosquistion time usually no mal. May show secondary postbaemorrhagic anaemia. Leucocyte

count variable See Onvalue p 1 32 Rabies.- Leep d g which has briten pat ent alive to observe symptoms. If dog bas been killed make smears from corne Ammonis and sta a by Giemsa a or M nn s

stain for A grabodies (See p 601)

Relapsing Fever -Exams e blood for spirochaetes with d k field or India ink method or in smea a stained by Wright a stain (They m y be absent from peripheral blood dury g afebrile period) If not found moculate a mouse and examine its blood after 24 and 48 hours Neutrophike leueocytoss m acute cases D fferentiate from malaria vellow fever Weil's dia ase

Rickets - Blo d phosphotus usually low calcium normal. In some cases calcium is low and phosphorus normal Prod et of Ca X P is bel w 40 and often below to Blood phosphatase increased Examine blood for annemia Rocatgenogram

Rickettsial Infections -In culate nearly grown male gui ea pig intrapentoneally with ce of blo d obtained during f brile period. Take temperature of pig regularly and watch for februle reacts n after 5 to 2 d ys W tch for swelling of scrotum and examine ser pings from tunica vaginal's fo Rickettsiae (Mooser bodies) Examine b am sects as for small probler tree nodules and persy scular militrations (See Table p 046) Test serum ! putient after 7 days f agglutm ns for Proteus OY 10 (Weil Fel v) Moderat neutr phile it cocytos (See also p 946)

Rocky Mountain Spotted Fever - (See Ricketts: 1 Infections)

Scables -With the aid of a hand lens e amine the infected skin for a black line which marks the tonn ! I I the pa assis. The female can be found at the end of the tunnel and emoved If paras te is not found look for ova in scraps gs from skin

Schistosomiasis.- Examine urine and faeces for ova particularly in masses of blood t nged mucus Blood in is the Examine blood for anacima and cosmophilia In late stages to t is er fun tion Complement is at on reaction sometimes not tive with special antigen

1682 APPENDEX

The Gonococcus and the Noch Weeks bacillus are usually responsible for the very acute cases of conjunctivities. Both these organizms are characteristically intracellular and are Gram negative.

In a genorrhoeal ophthalmia the secretion is much more abundant and there is an absence of contaminating organisms the reverse of infection with the configure A colaribativ As a matter of fact large numbers of * cotamination stay be present in the conjunctival secretion with only slight irritation being observable. Concernious ophthalmia seems to be remarkably infequent in the female children with goomerous vivio vaganitis. Gonorrhoea frequently loog after the acute urethritis may be responsible for rultis in men feattempty rate in women)

Initis and iridocyclitis are most often due to a focal infection but in the presence of a positive Wassermann reaction a syphilitic origin must be thought of

Conjunctivitis in the course of epidemic cerebrospinal meningitis and even panoph

thalmitis have been found to be due to the Heningococcus

The diplobacillus of Morax and Axenfeld is more common in chronic rather dry

affections of the conjunctival chefly involving the internal angle and showing a morning accumulation of the secretion. The bacilla are found to two more rarely in short chains. They are generally free but may be found in phagocytic cells. They resemble Friedlander's bacillus morphologically but do not have cappules.

In cases of ozaena with involvement of the nasal ducts I nedlander s bacillus may be found

Even in cases without oznena capsulated Gram negative bacilli of the Friedlander group have been frequently reported in conjunctival inflammation and in darry ocysius as well

The nodules of the eyebrows give the most convenient area from which to take material in the diagnosis of lepros; either the fluid expressed after scraping or a pace of tissue cut into sections. Conjunctival ulceration in feprosy may show shundard bacilli as is also free of corneal ulceration.

Ordinarily it is impossible to find tubercle bacilli in tuberculous conjunctival discharges

The discharge from a tuberculous dacryor; stitts may show them satisfactorly Animal modulation is preferable in the disgnosis of occlus tuberculous. The Paints occcus is however, the most important organism in dacryocystitis—rarely the colon basellus.

Choroido retinitis aveitis and other inflammatory lessons are frequently associated with a strongly positive tuberculus reaction and are attributed by some to an allergo reaction to products liberated from tuberculous lessons in other organs P Tulerensis—Wherty has reported cases of ulcerative conjunctivitis with lym

P Tulgrensu —Wherry has reported cases of ulcerative conjunctivitis with lym phadenitis of cervical glands fever and marked prostration due to infection with this organism

In keratomy cosis the cause has been ascribed to is pergillus funitatus

Trachoma is no v believed to be due to a filtrable virus. The trachoma bodies

A conjunctival irritation may be allergic to origin and in such cases the smear from

the secretion often shows the presence of cosmophiles

Animal Parasites —The larval form of Taenia solium (Cynicercus cellulosae) has a

prediction for eye as well as brain. It is usually situated beneath the relina.

The question as to the mature of the so called ophthalme lighes is taken up under trematodes. Echinococcus cysts have been reported in the other.

The adult Los los tends at times to appear noder the conjunctiva or in the sub-

cutaneous tissue of the eyelid

The larvae of Onchocerca solutius may be present (in chronic cases) in the comes and other tissues of the eye causing a characteristic punctate keratitis initis and eventually blundness

Fly larvae have been reported from the conjunctival sacs in the helpless sick species of larval sarcophagids having been reported as invading the conjunctival region in puriled ophthalmas

eyst a blood agar After the first week test blood for agglutining Differentiate from

Brucellosis plague

Typhoid Pever - \cutrophiac leuropema relative lymphocytosis cosmophiles reduced or absent. Blood culture usually positive during the first week later less frequently obtained Culture urine and facces on Endo Teague or bismuth sulphite medium. Vake no lutination test after 7 to 10 days. In suspected carriers culture unne and facces or duodenal contents. Differentiate from paratyphoid fe er brucel.

losis malaria typhus mihary tube culos s liver abscess kala azar

Typhua Feyer -- (See Rickettsial D scases) Undulant Fever - (See Brucellosis)

Urmary Tract Infections -- Luamine sed ment immediately in bangin drop and in films staned by Gram Collect specimen with sterile precautions or by catheter and culture on agar and blood agar plates. In special cases sea ch for tubercle bacille by stain and culture and confirm by gimes pig inoculation. D gest sediment in alkali it abundant or contaminated

War Wounds - Films stamed by Cram should be examined and cultures prepared both for aerobic (and by the No 3 jar) for anaerobic micro organisms. The presence of the gas barillus. Clost d m welch I can be demonstrated by moculating material into a tube of hitmus milk heating it to 80 C for an hour and incubating a anserobically for 12 to 8 hours. If this organism is p escut the so-called stormy is mentation results. It a not produced by pther anaerobes

To obtain pure cultures noculate 3 or 4 cc of the s hey int the ear vein of a rabbit After a minutes kill the rabbit and place the ar ass in the incubator for 6 to 8 hours The body should become distended with gas and the o gamen should be obtainable

from the foamy fiver or the heart blood (Welch Suitall test) If serum the any is to be used successfully in cases of gas gan rone it is necess by to determine speedily and precisely which of the asserobic organisms are present mace different antitoxic sera are required for each. Me ely to demonstrate the presence of Ci u leh s is not sufficient a nee many cases show mixed offect one with two or more anaerobes Henry (piz) has suggested a meth d for a quick identification of the important saccharolytic anner bes in wounds Cl wife Cl o d staf not in and Cl esdemat ent. The mate tal is inoculated into a co Led meat medium and f om this into a tube f milk. If the atorms fermentation o curs Cl is like is pres at. At the same time some of the cultur 1 noculated into two guines pig one of 1 hich has seceived Cl o d m t maign and Cl m i is antitionin and the other of thich has received Cl d m i m and Cl w i h ant town. If the first pig d east indicates that some o ganism ther than Cl d son malge and Cl u l h is present and this is m stolten the Cl d sale is This assumption is confirmed if the second p g survives If the second p g alone dies one m y d av the same conclusions with respe t to the C? If b th p es da either both of these organisms or some other anaerobes a e probably present and identification must be made by cultural methods (See also on sors and soro !

Yellow Fever - Darly neutr philic leucocytosis which in a fee days falls to normal or below. Increasing albuminum with granula, and epithelial casts from the first or second d y Ol guna r snuna m fat I ca es Bile pigments are present in blood and urme in nereasing amounts i om the seco d or third day. Inject blood of patient (during the bist three days) at accreb ally into mice. Serum of sa es after recovity shows life I me protective nower. Differentiate f. in severe mularia, blackwater fever

infects us jaundice r laps ng f ver dengue nilu maa. (Se also o 1624)

Screw worm Infection -To identify examine breathing slits on posterior stigmata of larvae found in auditory canal or skin ulcers

Scurvy - Tourniquet test of capillary resistance positive (as in purpura) Reduced

excretion of cevitanic acid in the unne May cause hypochromic anaemia Small Pox—Initial leutopenia followed by neutrophilic leucocytosis in pustular stage. Monocytes increased Try Panls or Mckinnon's corneal or skin rabbit inoculation tests.

Sprue — Examine the frothy pultaceous stools for undigested food and excess late (35% to 40%). Chiefly fatty scalls. Make gastine analysis (occasionally an achie indiral). Examine blood for nanctions unsulfy miscrocytic the perintious anatemis occasionally hypochromic. Blood calcium reduced. Glucose tolerance curve has late peak.

Sporotrichusis.-Culture on agar or potato for 8 days or more Direct smears do not show organisms

Syphuls — Permary stage Look for T pallidum in serous estudate from chance in dark field preparations (or stained films)

If negative and ulcer is healing examine juice appriated from responsable to

Secondary teritory and latent cases. Make Wassermann reaction or florculation tests. Farames spinal fluid if chinical evidence of disease of the nervous system is present and in all cases before treatment is storoned.

Tetanua.—Inoculate white mouse or guines pig and make anaerobic cultures from curettings from the wound (See p. 1600). Rarely found in smears. Inject filtrate from culture into two guines pigs one of which should be protected by injection of antictance serium.

Thrombocytopenia.—(See Purpura thrombocytopenic)

Thrush.—Nake scrapings from lesions and examine in 10% KOII solution. The organism. Springerpora elbians: hasy be cultivated on Sabourauds medium. It slowly liquefless gelatin, and blood serum and acidifies and clots milk. In cultures there

are budding yeast like forms and mycehal threads

Transfusion — To select donor secure individuals of the same blood group (or group 0) and match the serum of the recipient with the cells of the donor and vice versa. Exclude syphilis by Wassermann or Kahn test and by phyrical examination Exclude malaria by history and stained thick blood films.

Trichiniais: — Usually high leucocytosts and cosmophila. Secure su pected meat eximine for negretided larse an press preparations or digest in artificial gas rise and collect larse in Baermann apparatus. (See p. 1243.) May feed meat to rat to mouse and eximine muscles unmaintay after to day. During second or bird well to to to co of blood in dulute actus acid and examine accliment for larves. After second week, excise a but of insucie from delload or pretorable near insertion and examine

Make intracutaneous test with Bachman antigen

Trypanosomass - Lamine blood for trypanosomes in fresh preparations or staned their films When sparse concentrate in blood by centrulegization and rate films from leucocyte layer (See p. 191). If not found inoculate a rat or guineapse intrapentencilly with blood gland puice or enulusion of exceed gland and example blood at intervals. Formol gel test often positive. In lethargic stage examine spinal duid for praises. Cell count and globulin acressed. Differentiate from kala sar malana syphilis.

Tuberculous - Vlake acid fast stain of smears from sputum facets or unnary

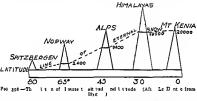
sediment. If necessary first concentrate by digesting in alkali or antilorone and centifagaliange. Culture on Petroff's medium or in Corpet's medium. Inoculate gunetpig. Blood cultures may be positive in milary tuberculoss. High monocyte framphicete ratio indicates progressive fesson. Positive diazo reaction in unic antiunisvensible say. In appetial cases make intracutaneous or subcultaneous tuberculos tests or inchildren von Priquet's cultaneous test. Sedimentation rate increased in propert on to activity of dia se.

Tujaramia—In the early stages moculate mouse or guinea pig with material from local lesion or regional plands or with blood. At autopsy look for characteristic letions (small caseous for in organ) and make cultures from blood and organs on glicose

aught and day may not exceed in I and the seasonal fluctuations are small. During a prolonged dry season the desert type of climates a approached and in the course of a long set season humidity increases and temperature tends to decrease. Some of the constail climates are similarly modeled by seasonal tands wands. The effects of the monsoons of India extend far inland. They bring with them rainfall and lower tem peratures. The climates of small slands are especially equable. Temperatures tend to large higher in the interior of large land masses than on the coast and mountain ranges may determine the distribution of rainfall. This is notably true in tropical South America where there is abundant rai fall cast of the Andes and aridity on the western coastal plain.

The mean annual temperatures in the tropical belt in general cary from 50 F to 84. When there are clearly defined wet and dry seasons the wet season is comparate ely cool. Annual rantall in the trop cs assemily 40 inches or more. At Poerto Bello in fanama 24, inches have frequently been recorded and in the Khasia fills in Assim it has reached 600 inches.

Assum it has reached occurred in the north temperate zone are frequently higher for short periods than it se encountered in the hot and humid tropics. I'll effects of chimatic heat therefore are not himsted to the tropical belt.



Mountain Climates.—Temperature v ness nive sely as the altitude. Herisch has shown at that f every soo feet of nicroses as altitude there was a decrease of 1 F and for ery 150 metres a decrease of 1. C. These statements are only partially correct how evt as the temperature at a given altitude dep not in part upon the expansion and bumship of the air the de r ess of the atmosphere the quantity of earth and the bumship of the time. An interesting comparison showing that all the hot is much on a cit time. An interesting comparison showing that all the hot is much on the statement of the present of the

IMPORTANT CLIMATIC ELEMENTS AND THEIR EFFECTS IN BRIEF

Heat Humid ty and Air Movement.—The chimatic factor of principal impo tance in the tropics is heat. Chim tic heat becomes particularly 1 imited to health when it

Section III

TROPICAL HYGIENE

CLIMATIC INFLUENCES

Trobical Climate

Foreword.—In Hopkins (1933) Treates on Boodimattes Figure 55 (derived from Supan 1 temperature zoose Bartholomes a Physical Attas, 1950 vol. III (Veterology pl. D. Booss that the heat equator which represents the line of maximal mena annual temperature in the tripical zoon less for the most part at a considerable distance north of the geographical equator. In Central America and Menico it bends northward to about 5 above the Tropic of Cancer (which is at 23 N) and mapt of Africa that is no N latitude. Analogous curves are found in the softeness of 85 F (18 C) which dimits the some of tropical their on the north and on the south. The northern limit dimits the some of tropical their on the north and on the south. The northern limit through the Wichtermann Sca. to the north of 4 white in II India and though the southern part of China. The southern hand bench sharply northward along the western slopes of the Anders in South America and to a less degree near the western cost of Africa and it passes south of the central portion of Australa.

Life must adopt useff bowever not to climate in terms of averages but to the fluctuations of weather which may be irregular seasonal monthly or diginal. There fore the classifications of elimates in terms of average figures whether for tempera ture hundiny ramifall or baronetine pressure are inadequate indications of the possible influences of a given climate upon man. Moreover elevation above sea level, the proximity of mountains or of oceans, ocean currents and prevailing smals modify local climatic conditions to such an extent that floatings when the not off gridstant from

each other may have very different climates

For detailed information on climater the reader may consult the larger works such as the Handhunch for Klimatologue by Kloppon Graz and Gengr (1918) or he may find all that he requires in Kendrew's bittle book. The Climates of the Continents (1971) or in C E P Brooks Chamte (1932). The Climate Maps of North America (C F Brooks 1936) show sea level notherms and actual average temperatures for various months the mean canual range of temperatures the mazimal and minimal temperatures and similar data for barometric pressure rainfall snowfall, humidity cloudiness and thuodort storms.

Thornthwatte (1933) has published a brief classification and description of the climates of the world on a quantitative basis together with a climatic map in color There is a dearth of weful books on medical climatology. Climate and Acclimation and edition 1938 by Castellani contains much valuable information in concise

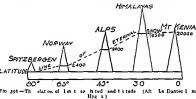
form
The knowledge of the effects of chmates upon man is 80 meomplete that an elaborate
classification of tropical climates as not needed here. Tropical climates are of three
principal types the hot and dry the bot and human and the wet-dry climate is back
are characterized by alternating scannes of drought and of her which her
are that certained by alternating scannes of drought and of her which the
days are also become and the contraction of th

night and day may not exceed to F and the seasonal fluctuations are small During a prolonged dry season the desert type of climate is approached and in the course of a long wet season humidity increases and temperature tends to decrease. Some of the coastal climates are similarly modified by seasonal trade winds. The effects of the monsoons of India extend lar inland. They bring with them rainfall and lower tem peratures. The climates of small islands are especially equable. Temperatures tend to range higher in the interior of large land masses than on the coast and mountain ranges may determine the distribution of rainfall. This is notably true in tropical South America where there is abundant rainfall east of the Andes and aridity on the western coastal plain

The mean annual temperatures in the tropical belt in general vary from 80 F to 84 F When there are clearly defined net and dry seasons the net season is com paratively cool Annual rainfall in the tropics is usually 40 inches or more. At Puerto Bello in Panama 241 inches have frequently been recorded and in the Ahasia Hills in

Assam at has reached 600 mehes

The summer temperatu es in the north temperate sone are frequently higher for short periods than those encounte ed in the bot and humid tropics. Ill effects of climatic heat therefore are not himsted to the tropical belt



Mountain Chimates, - Temperature varies inversely as the altitude Herschel has shown that for every 300 feet of more se m altitude there was a decrease of F and for e ery 80 metres a decrease of C These stat ments are only partially correct how es it as the temperature at a given altitude depends in part upon the expansion and humid ty of the au the clearness of the atmosphere the quantity of earth and the nature of the wind hi wing at the time. An inte esting comparison showing that aftitude h s as much to do with climate as latitude is afforded by the annual mean tem peratures for several places a the Island of H to Port au Prince on the coast at approximately sea le el has an annual m an temperature of 8 F Petion alle 4 miles 1 land with an elevation of about 400 leet an annual mean temperature of 76 F and Fu cy 12 miles i om the coast at an altit de of about 5000 feet an annual mean tem pe ature of 66 F. Pine trees are lound in the higher altitudes of the island. The highest altitudes of M unt K nya located t the equator about 300 miles from the east coast of Africa are clothed in pe petual an w Anrth or south of the equator the snow line gradually descends until t about 80 north and south latitude it reaches sea level Th s is shown in the ccomp sing chart I om Le Dautec

IMPORTANT CLIMATIC ELEMENTS AND THEIR EFFECTS IN BRIEF

Heat, Humid ty and Air Movement.-The climatic I ctor of principal importance in the t op cs is heat. Chimatic heat becomes part cularly inimical to health when it

reaches levels which render difficult the dissipation of surplus heat from the human body Lower levels of temperature may become minuted in this sense when heat dis sipation is retarded by high relative humidity of the atmosphere or by the absence of Conversely the effects of high temperatures are mitigated by low humidity or by air movement. These factors promote rapid evaporation from the skin and thus they increase the efficiency of this cooling mechanism

It is useless from the point of view of medical chimatology to discuss separately the effects upon man of heat humidity and air movement. Attempts to assess chimatic

environment in terms of these factors will be dealt with on page 1600

When as a result of exposure to heat the heat regulating mechanism of the body fails to prevent a considerable rise of temperature heat pyrexia (p 1085) results. When the circulatory mechanism fails to respond to the increased stress imposed by high temperature heat exhaustion (p. 1090) develops. Heat cramps (p. 1091) are induced by excessive loss of sodium chloride in the aweat Dehydration of the body is a factor which may aggravate the ill effects of heat Schlegel (1941) has studied variations in the heat regulation of the human organism with particular reference to the water and salt losses caused by high temperatures. The experiments were conducted at a tem perature approaching 40 C (104 F) and heneficial effects on the heat regulating mechanism were found to result from the administration of renal cortical hormone Under the influences of the hormone there was considerable increase in sweat loss Six subjects were unable to continue the control experiments without hormone. Without harmone administration the pulse mounted rapidly but with hormone the pulse was steady 80 to 90 throughout the experimental period. They thought this work indicated that acclimatization to a hot environment may be accelerated by the use of hormone

Atmospheric Pressure - Cenerally speaking high pressure is recorded at sea level about 30 degrees north or south of the equator This high pressure decreases towards the equator due to the heating of the air by the sun a rays and to the addition of aqueous vapor which heing lighter than the air ascends with considerable force to very high altitudes. A normal man can frequently nithstand a pressure of one additional or two absolute atmospheres in diving operations over a considerable period of time and ascend to altitudes of over 15 000 feet without great difficulty. It is uncertain honever whether the slighter variations of pressure are significant from the point of view of bealth

Storms -Local severe thunderstorms are frequent in the wet tropics Generally they cool the atmosphere for the time Besides these eyclonic storms which receive different names in various parts of the vorld occur at infrequent intervals. They are called cyclones in India and Mauritius hurricanes in the West Indies and typhoons in the West Pacific and contiguous seas. It is probable that hurricanes have been an important factor in the lack of progress of the white race in some of the islands par ticularly of the Bahamas and West Indies

Altitude -Mankind can live and has established permanent habitations in Tibet at places over 4000 meters above sea level In the Bolivian province of Chichus people hve at an altitude of 5000 meters A moist tropical chimate is the result of heavy rain fall combined with low elevation a hile in tropical mountains with sufficient elevation every variety of climate may be found. At Nairohi in Africa which is 3 degrees south of the equator but has an altitude of from 6000 to 8000 feet the chmate vanes from cool to cold in the higher elevations while hot tropical conditions prevail on the coast

Altitude is important because of its effect in tempering the heat of the lowlands and in providing sites for sanatoria and rest camps for rehef from the heat and humidity of the coastal plains Baguio in the Benguet Mountains of the Philippine Islands about 170 miles north of Mamia is considered by many as one of the best tropical mountain resorts in the world It has an elevation of from 4500 to over 5500 feet and surrounded by ranges extending up to almost 8000 feet It is a region of pines and oaks and has a perpetual temperate climate with occas onal frosts The maximum annual temperature is reported as about 80 f minimum 53 4 f with a mean annual temperature of 64 2 f Open fires are comfortable morning and evening throughout the year and strawbernes are grown during eight months of the year Heavy rains are prevalent however in the summer months The summer capital of the Archipelago and sanatoria both civil and military are located here Hintze in his report on the German colony of Espiritu in Brazil says that experience has shown the settlers that it is advisable first to colonize the elevations of from root to 3000 feet and that if this be done the later generations can successfully occupy the lowlands not even excepting the coastal f 715 COO clusion is logical but in most tropical places it is next to impossible y siderations for people to live away from the steamy coastal p

For all effects of altitude and adaptation

Sunlight .- The s lar spectrum contat s heat rays extend; g from infra red to red hight rays which are yellow and chemical rays extends g f om the blue to the ultra violet. The rays reach the earth accords g to Langley in the following percentages

	Per Cent
Ultra violet	39
Vio t	42
Blue	48
Greenish blue	54
Yellow	63
Red	70
Infra red	76

These values are modified considerably by alt tude fatitude season cloudiness and atmospheric humidity Only about 50 per cent I the sun a rays reach the surface of the earth at sea level in contrast to 5 per cent in clear weather at altitudes of 1800 meters. In the clear atmosphere of mountains, there is a higher proportion of light

rays and of ultra violet rays (Bews 0:6)

The spectrum in the tropics extends to the same are lengths as in the temperate zones The rays at the violet end of the spectrum which reach the earth are filtered out by the skin itself a d by the blood circulating a the capillaries of the skin rays can cause hyperemia or turning of the supe to al layers of the skin and they promote p ementation. Litra vi let rays can kill bacteris. The skin piement melanin absorbs the light rays except th se t the red end of the spectrum. After absorption the light rays are converted into heat. It s for this reason that begroes

when exposed to sunlight sweat more readily than Whites

Pigmentation of the skin can be promoted of only by di ect sunlight but also by reflected or diffused beht or by wind. The skin of blands shows little tendency to become pigmented with the result that it may burn gain and again. Brunettes as a rule tan readily. When the ughly pigmented the skin is highly resistant to sunburn After exces twe exposure of large a eas of sk n to the sun white persons whose skins are not protected by p gme t m y suffer fr m se ere hyperaemia and blistering of the skin accompanied by co st intional symptoms su h as chills ausea headache comiting and a feely g of exhaustion. Local inflammation induced by sunlight has been attributed to the mob lization of histamine f om the skin into the ti viet and to putrition lake ations of the traues. Inte se sunlight as belie d to induce raccumu

lat on of cholesterol in uncovered skin surfaces (Guetrini 930)

Sunlight seems to stimulate the nervous system. This effect is beneficial within hearts but repeated e posure to intense sunlight has been thou ht to be a factor in the causat on of tropical neur sthen a Not infrequently intense light whether di ect or reflected causes conjunctivities retinities photophobia beadache or dizziness

When overhating of the body results from direct exposure t sunlight in co junction with high tmospheric temperatures heat pyrexia (p 1035) or heat e haustion (p 1000) may develop. These effects are not caused however by light as such but hy

heat Among ill effects upon the skin which can be produ ed by repeated e posure to intense sunlight are \ ode a p gme t su se ere semle keratosis and epitheli omatosis. These conditions are seen occas onally in white persons who have li ed for a long time in the trops s Two cases of 'kerod rma pigmer tos im occurring in Spanish

Indian child en of the same family have been reported from hucatan (Shattuck 1033) James II Smith (031) beheved that the distribution and 1 cidence of pellagra are influenced under certain abnormal conditions by solar irradiation. He said that an adequate supply of sulphur as cystine and a no mal metabolism of sulphur appear to exert a protective influence aga st the pathologic effect of solar irradiation

The injurious effect of sunlight up in exposed ski surf ces in typical cases of pellagra

has long been known (p 1058)

EVALUATION OF CLIMATE

There is a great mass of meteorological data from many parts of the world on atmos pheric temperatures humidity and air movement. The relative frequency of bright sunshine and of cloudiness has been often recorded from many places also Solar radiation reaching the earth's surface has been studied quantitatively in certain locali Something is known too of the varying proportions of the solar rays of different wase lengths which reach the earth But the physiologist needs far more information about atmospheric and chimatic environment than is available today before he can undertake to assess the possible effects upon man of the vanous components of atmos pheric and chimatic environment. For example in addition to the factors already mentioned dust content of the atmosphere may be significant by virtue of its power to reduce solar radiation reaching the earth's surface. The possible influence of atmospheric electricity and of cosmic rays is as yet unknown. Some physiologists believe that climate is not accurately reproduced experimentally even when tempera ture humidity air movement and dust-content of the air are controlled

Over a period of many years attempts have been made to evaluate climatic environ ment as it affects man Haldane (1905) emphasized the fact that the readings of the wet bulb thermometer are of greater value than those of the dry bulb for this purpose and he pointed to the significant effects of burniday and of air movement. Man however does not respond like a wet bulb thermometer. The kata thermometer was designed to overcome some of the recognized difficulties of evaluating atmospheric conditions Its use was first described by Hill Angus and Newbold (1928) (See

also Castellani 1918 p 44) Phelps (1928) stated that in American Samoa persons not exerting themselves are uncomfortable unless the cooling power of the air measured by the wet Lata thermom eter is as great as 11 0 and that comfort in the performance of physical work requires even greater cooling power Buxton in Samoa found that the readings of the dry hata thermometer at 9 a m averaged 3 a for February and 4 3 for July At noon the minimum reading of 3 o was found in December and the maximum 4 6 in July pm the monthly averages varied from 35 to 50 Corresponding wet hats ther mometer readings averaged 13 5 to 18 3 12 9 to 19 4 and 13 0 to 20 0 These figures Sundstroem states do not show any extreme reduction in cooling power but the con tinuous exposure even to such moderate reductions is an important factor of cooling power at the disposal of tropical residents is usually diminished by defective

housing and unsuitable clothing The cooling power of the air may be determined by the wet or dry Kata thermometer Orenstein and Ireland (rosr) found that when the cooling power of the atmosphere was below six millicatories per square centimeter of body surface per second and 16 milli

calories by the wet kata thermometer the working efficiency of a native of the tropics decreases

Yaglou (1927) recommended for the evaluation of chinatic environment the use of the effective temperature under. It is an arbitrary index of sensation based on the sensation of warmth resulting from various combinations of temperature humidity and air movement. He said that all measurable physiologic effects of the physical environment upon industrial workers whether at rest or at work correlat well with this index For the sedentary worker be determined that about 60 effective tempera ture (E T) was optimal but that it varied with the season of the year for light work in hot industries the upper limit of ability to compensate for external temperatures was an ET of go degrees The limit for heavier work was an I'T of 80 degrees

A similar method of assessing tropical climate has been recommended by Lee and Courtice (1040) for use in classifying tropical chimates with reference to problems o settlement by Europeans The ET of Lee and Courtice takes into account environ mental temperature humidity and convection. Some correction can be allowed for radiant energy. Their Figure I shows a normogram of ET by Houghten for men normally clothed and engaged in light work in which the variables dry bulb tempera

ture wet hulh temperature and avera e air velocity are represented. Given the value of these three variables the ET can be read off directly from the normogram

HEAT PRODUCTION AND CONTROL

The average temperature in the mouth varies from 06 F to one slightly below 00 Γ and the rectal temperature from q7 2 F between 2 to 5 a m to q9 4 F between 4 to 7 pm Pembrey gives the mean daily temperature as being 98 6 F the maximum 99 5 F (37 5 C) and the minimum 96 8 F (36 C) It is believed that temperature regulation is the function of a center located in the thalamus Maintenance of normal body temperature in man depe ds on the ability to effect a halance between heat production and heat loss. Heat is produced in the body chiefly by the exidation of to ds particularly earbohydrates and fats. A large proportion of this heat emanates from the muscles even when they are at rest. Muscular tonus and consequent heat production is increased by nervous tension. Still more heat is produced by shivering and by voluntary muscular activity

Mechanism of Heat Loss -Heat is dis mated chiefly from the skin by mechanisms

which have been defined by Waggers (1939) as follows

Conduction signifies the transfer of ener y from one particle to the next through molecular vibration

Convection 5 gnifies the transfer of energy by moving molecules of air which absorb heat and move on

Radiation signifies the transfer of infra red (heat) waves through the other

without involving a material aubstance Vaporization of water requires the absorption of o 58 calor es for each gram of 1 ater

vaporized at 37 C At an atmospheric temperature approaching that of the human body vaporization accounts for most of the heat loss from the body At temperatures above that of the body the effects of conduction convection and radiation are e ersed Vapori ation

then becomes the only significant means of di sipating beat from the body. Vapor a tion of water takes place chiefly on the surface of the skin and to a lesse degree in the lungs The property of water in changing from a liquid to a gaseous form to absorb heat and hold it as latent heat until condensation occurs makes possible the rapid removal from the body of great quantities of heat when temperature humdity air

currents and the clothing worn promote f ee evaporation Hardy and Du Bo a (1037) stated that in the temperature range from 30 C (87 F)

to 32 C (gr F) the body clims ates a minimum of heat and that the amount equals the basal heat production Beyond this range in temperatures which are e ther hotter or colder the heat I ss is effective down to 9 C. At temperatures below this level some mechanism as yet undetermined induces tension of the muscles or shivering with resulting increase in basal metaboh in and heat production. Du Bois (1938) emphasized the fact that the skin is alm at entirely esp unible for heat loss and that it is admirably adapted to serve as a heat regulator

Sue ting 1 the princip I means f p omoting cooling by vaporization. Experiments have shown (Kuno 1934) that visible sweating can be produced by thermal agents or hy mental or sens ry st m is. The sweating which is caused by thermal agents involves the entire body except the palms of the hands and the soles of the feet Sweats g caused by stimuli other than heat is usually I mited to the nalms the soles and the axillae

Ordinarily thermal sweating induced by exposure to moderately high or very high ar tempe atures begins after a cons de able latent pe sod (Kuno 934) The amount of sweating is roughly prop tional to the degree of h at to which the subject is exposed In moderate heat there are marked fluctuations of aweating At higher temperatures these fi ctuats us tend to disappe r It is ev dent that the co long effected by sweating is determined not by the quant tes of awest produced but by the amount which evapo rates on the surf ce of the body Evaporation is affect d hy various external factors including humid ty a r motion and clothing Nelbach and Harrington in the study of hygroscopic properties of clothing in relat on to human heat loss state that in changing a clothed subject from a low to a high relative humidity at the same temperature, the subject appeared to produce more heat than could be accounted for by his metabolic rate This process is the reverse of evaporation and was due to the absorption of mois ture by the clothing with a resulting evolution of heat S ence (05, 387 1942)

The stimulus which induces sweating has been ascribed to increase of body temper ature but Drinker (1036) behaves that it is caused usually by impulses generated in the nerve endings of the skin

Invisible or insensible perspiration is continuous Benedict and Wardlaw (1932) stated that within certain limits this evaporation of water from skin and from the respiratory passages accounts for approximately 25 per cent of the total beat loss from the human body. When measured under basal conditions the rate of insensible perspiration soon becomes constant Sleep during the daytime has no significant effect on the rate of invisible perspiration but it falls markedly during sleep at night Of the total heat loss by insensible perspiration about 15 per cent comes from the bands The rate of loss from the hands and feet is about three times greater than that from the rest of the skin per equal unit of area. In the absence of visible sweating about 7x per cent of the heat loss is accounted for by conduction convection and radiation

Hardy (1934) has pointed out that the skin of the Negro is not truly black and that the visible color of the skin is insignificant so far as its radiating poner is concerned Light of the shorter wave lengths is reflected from the skin, but the longer wave lengths including the infra red are absorbed. Hardy showed that the skin acts like a black body radiator that its emissivity is close to 100 per cent and that the presence of nater vapor or of CO in the air has no appreciable effect on radiation from the skin

PRYSIOLOGICAL RESPONSES TO CLIMATIC HEAT

Basal metabolism may fall moderately within a few days after entering the hot tronics. This reduction may persist until the individual returns to a cool climate after which the metabolism returns rapidly to the original level (Drinker 1036) When heat causes a rise of body temperature the metabolism increases in consequence Such increases of temperature commonly follow physical exertion in a hot environment

Mason a (1940) long series of observations on 21 Finglish and American women who went to live in southern India reveals the fact that the metabolic response of individuals differs One group (Type f) comprising 13 of the women (62 per cent) showed a fall of metabolic rate averaging about 10 per cent whereas the remaining 8 nomen (Type II) showed no significant change in the metabolic rate. Mason says in conclusion

There is as yet no real evidence that one type of tropical response is a hetter adaptation than the other

MacGregor and Loh (ross) have also shown that basal metabolism may show a definite reaction to tropical environment in certain individuals and be absent in others Body Temperature -- According to Drinker (1936) a slight increase of body tem

perature is the rule in the tropics In Mason s cases of Type I (those showing a decrease in basal metabolism) the average body temperature remained unchanged but the temperature for those of Type II (no significant reduction of basal metabolism) showed an average mcrease of 0 6 I

Castellani (1935) said that he and Chalmers had not found any change in body temperature in passages going to and from the tropics or during residence therein provided that the individuals observed were normal. Neither did he observe any difference of body temperature between well nourished healthy natives and Europeans with due allowance for individual and seasonal differences and the effects of exercise He discussed matters relating to body temperature in considerable and clothing

detail Pulse Rate - Drinker (1936) said that a slight decrease in pulse rate usually occurs but that changes reported are very magnificant. Manson's Type I showed an

average fall in pulse rate of xx 8 whereas in Type II the fall was only 7 2 heats per The changes in pulse rate in different individuals ranged from an increase of

one beat to a fall of twenty-one beats per minute In the majority of Europeans no change in the pulse rate was observed by Castellani (1038) either on entering the Tropics or after residing there. In a few persons the rate showed a slight increase at first. This disappeared after acclimatization

Systolic Blood Pressure -Drinker recognized the existence as a rule of a very shight decrease Reporting on 18 female anbjects Mason observed an average decrease of 5 mm in the systolic and in the diastolic pressures as well The range of variation in the systolic pressure was from plus o mm to minus 22 mm. The range for the diastolic pressure was from plus 2 mm to minus 25 mm Other observations in hied Mason to believe that circulat ry changes as reflected in pulse rate and blood pressure may not take place so quickly as changes in heat production or body temperature

Roddis and Cooper (Castellans 1938) who observed a large number of naval off cers while on duty in West Indian waters found the average systolic blood pressure to be rr 5 points lower than the standard for the temperate zone The blood pressure fell gradu lly Sixtee 1 of the off cers showed an average ri e of systohe pressure of a noints one month after return to the temperate zone

Respiration .- The evaporation of water from the lungs a sists in the re ulation of body temperature. Due to the increased distribution of blood to the surface of the body the lungs weigh less in a hot than in a cold or temperate climate. The capacity

of the lungs is therefore mereased

Drinker (1936) said that the respiration rate tends to decrease and the minute vol ume to increase The greater minute volume promotes cooling by increased evapo a

tion of water

Blood Volume -Plasma volume was studied in four subjects by Talbott Tdwards Dill and Drastich (1933) in Boston and subsequently in the same subjects at Boulder City Nevada where the summer temperatures are higher than those of the hot most tropies where the humidity is low. They reported that the small differences observed were within the limits of error of the method. However Barcroft and associates (Drinker 1936) on an expedition from England to Peru fou d that blood volume increased as the tropics were entered. Commenting on these bservations Drinker said that the necessary increase of sweating must require a consta tly higher blood supply to the skin and if the blood volume did not increase amy overs himent of the internal organs would result. It seems possible that such an impoverishme t may occur in some of the r dividuals who fail to adapt adequately to tropical en ironments and who in consequence exhibit marked dec ease of efficiency when hiving in a tropical

ens ronment In a very recent article Forbes D il and Ifali (1040) reported their observations on to whites who had moved to a hot damp climate. Small increases of about 5 per cent

in the volume of the blood and in the plasma volume were observed Interstinal Fluid - The authors quoted abo e obser ed in the same series of suh jects a dec case in interstitial fluid (outside the cells and outside the blood vessels) which averaged per cent. The r are howe er varied from minus 24 per cent to

plus 16 per cent Composition of the Blood -Red cells are apt to be increased and a hite cells decreased slightly Blood sugar may h low A shirit alkalos a has been reported particularly in persons of sede tary habit but it disappears with the assumption of periodic exercise

(Dn ker que) Sundstroem (q26) has reported observations on the blood of white residents of northern Australia. Some of his findings are at an ace with those of other ob ervers He recorded reduced ie els for tot I phospho ous in the blood Talbott et al (1021) reported th t changes i on normal in the constituents of the blood a e small after

adaptation to chimatic heat has occurred

Commenting in the pallor of the skin of the face, which is common in white resident of the tropics. Castellam (1938) said that there is no foundation for the belief that this pallor is caused by a physiol gical agemia. In his expenence blood sug ris not decreased

D gesti e Functions, -It is common in periods of hot weather in a temperate climate to experience a marked loss of appetite. After his g for some time in the Tr pics northern Whit s are apt to e light a persi tent reduction of appetite which is often accompanied by an increased or song for highly spiced foods and fir liquor before the e en ng meal The loss of appetite might well b attributed to a dep essio of the digesti e f cti ns and a reduct on of the di estive secretio s Castellani (1938) has pointed out that Arnold's e pe iments on dogs which were kept in an artificially warm and moist atmosphere ab wed a decrease in gastric secretion and a fall in acid ty He

also emphasized the tendency to constipation which occurs in man particularly in the hold of chimates. He attributed the constipation in part to loss of water by evaporation and deficient ingestion of fluid and in part to insuitable dut. He asked the so-called tropical liver to excess of food and drink in some cases and to latent or seem latent amounts began that in other instances.

Urmary Excretion -The composition of the urine in the tropics has been investigated by several workers who agree that with the exception of a tendency to high concentration it corresponds fairly well with accepted standards Because of the loss of water by increased personation the urinary excretion is reduced to approximately one ball that of the temperate regions It has been suggested that high concentration may in time be injurious to the kidney epithelium and that toxic products otherwise innocuous may become harmful by mass action. On the other hand nephritis is less prevalent in the tropics than in colder chimates. Enkman stated that the white man sweats more comously and produces more urine than the native of the tromes but that this increase is not merely the consequence of his taking more water and the kidneys of the white man show a greater activity as compared with those of the This response is independent to a great extent of the water intake fore the white man must drink more in order to maintain the water content of his body No doubt the greater activity of his kidneys is to be accounted for by the fact that he has to exercte nearly twice as much introcen as the native. Eukman found the weight of the kidneys of the Malayan in relation to the total body wright to be about the same as of the European

Talbott et al (1933) studied workmen engaged in the construction of the Hoover Dam floudior Dam near Boulder City Nevada where the summer clamate is intensify hot and dry They observed a loss of body weight in the first days. The fluid make was greatly mertaged and it was correlated with mercare of atmosphere temperature. The volume of the unne underwool hittle chaoge but the specific gravity rose at first from rogo to rogs. After a person of adaptation the specific gravity of the unnefel from rogo to rogs. After a person of adaptation the specific gravity of the unnefel from rogo to rogs.

to fort of 1020

Chloride Excretion —The a mount of sodium chloride lost in the swa at was great in the first days of exposure to high climatic temperature. There was a consideral diminution of chloride excreted in the onne. After adaptation the percentage of sait in the aweat became decreased and the exerction of chloride to the unne increased. Similar chances in fluid balance and in a chloride exerction doubtless occur in the tropics.

whether hot and dry or hot and bumid

Endocrase Giands — At first tropical climates appear to stimulate the thyroid the adrenal glands and the gonals. Subsequently glandish activity seems to be deproduced the reduction of blood pressure and the feeling of lassitude which commonly affects northern whites after a period of readence in the tropics might be explained on the production of dimmained endocrate activity. Huntington a thesis that a changeable climate with periods of old weather and frequent storms has a timulating and beneficial effect upon man suggests that these climatic conditions may augment the functioning of the endocrane clands (see also p. 15 too).

Reproduction — The tertility of both males and females from the temperate zone seems to be dimmshed by the in the Tropes. It what gain is the time of beganning of mensitration is unchanged. The menopause comes surfier (Drinker 1936). According to Castelland (1938) mentistration tends to began about a year enation. European gifs lying in the tropics i e at the agrea fig to 14 instead of at 14 to 15 years. In Euranan and East Indian grifs meastraturous begans at 11 or 17 years of age in the majority of instances. Little is known of the time of onset of clumacteric either in native racts of the tropics or in European somen thrug there. In the latter the time of onset appears not to differ from that which is usual in Europe. It occurs usually between 14 and 50 years of age.

Growth—White children raised in the Tropics tend to be long legged and thin Tatiess is uncommon. The rate of growth is increased. It is most rapid in the botter months. In proportion to weight the tall this type offers the maximum surface for

heat radiation This adaptation may be advantageous (Drinker 1936)

Merrous System.—It is recognized that pooling of residence in a tropical courton mornt may sifter appreciably the meant activity and the project sections of Whites from the north temperate zone. For this reason American and British firms doing humens in the trop is provide long vactames for the employes living there. The usual interval between such vacations is about 3 years and the vacation period is about 6 months. The supposition is that the employe will spend by actation in a cold climate. However the American employe locality returns actation in a cold climate. However the American employe locality returns actation are consistently provided that the spending state of the state of the solution of the state of the solution of the state of the solution of the state of the solution of the state of the state of the solution of the state of the state of the state of the solution of the state of the stat

It is extremely of ficult to distinguish the possible effects of climate from those of the many other everyonemental factors with a seem to be a synificant. The tropract climates in general are monotonous and lacking in the attinuiting effects which have been attituited in cool climates and changeable weather. Life too is monotonous in many tropical stations. Usually the social group is small the espectations of extreme and extreme and extrement in the contract of the contract of the contract of the contract of the contract of the contract from home test stend to undertime morals and to exaken the subhibitions. Prices of dimage full centrol contract and detectment from home test stend to undertime morals and to exaken the subhibitions. Prices of of memory steeplessness necessablems, symptoms abnormal irritability and universable contracts. The contract of the proposal contracts of the proposal contracts of the proposal contracts of the proposal tropical exercisions of virtal rate of common is resident of the Tropics that tropical interpretations. Sometime of the proposal tropical exercisions of the proposal contracts of the proposal tropical exercisions.

Unbygs at babits including failure to take regular secrois are frequently responible, in the Tropics for depressed mental and ply real upor. In other instances statistis malaria and it beavy dooses f quanane taken for its treatment are depressing factors. It is easy to believe this the individual constitution may morntimes play a determining part but missionaires and others who are deviated to their tasks may work hard for period of many years in the severest of forested climates without going says and the proposed of the severest of the proposed climates without going says good half the severest of the severest of the popular and physical illed feels which chings and other factors of the tropical enumonisment tend to produce

The Sign —In hat weather body temperatu e at regulated chiefy by the evaporation of water from the surface of the size at Aron (1921) conducted must little measurement. Min is and found that the naked human kin if exposed to the rays of the sun is assumed evary spill yet about 36 C. If one not see kept in the shade and the other exposed the difference in temperature between the two sides my amount to 3 C. Above 36 C. When 36

ton is increased by performing noiseads work in the hot aim.

Effects of Heat upon the Whate and Brown Races—As the brown sian absorbs more
be t than the whate skin the p int whe e perspectation shows is reached more rap dly
by the hown skin thin by the show skin ander smaller could tons indicating that the
by the hown skin that by the show skin and the smaller could tons indicating that the
state of the state of the

lost when men are working stripped to the waist may be absorbed by a close fitting clustic cotton union suit and distributed uniformly over the entire surface by capility action. This climinates the bearing effect upon areas of the body which otherwise become dry while other parts of the body surface are adequately cooled by the exportation of abundant betweenton.

I iskman found no perceptible difference in the number of sucat glands between the brown and the white race but counts made by Clark show that the darker skins contain a larger percentage of sweat glands than the light r. Persons who do not perspare or who have a defective sudoring system are not studed for greatence or the trainer.

The sweat secretion of the white man in the trop response beyond the limits of efficient heat regulation and become superfluous so that the skin and clothes become most This together with the narm most are increases the lequence, especially in the perent armal of common hacterial and my cotic skin infections and before tropics of so-called prickly best from which bast mared condution the narties seems to be exemit

Hair and Naik——It has been stared that the hair and nails grow more rapidly in the tropics that on the temperate some. Sundtherem (1996) however (south the hair grow at a rake which averaged it is above in the trop its than in a temperate climite. The most rapid rate councided with the first part of the oppressive easons when climite functions were also improved, while a sudden declore in the rate of growth occurred when the metabolic processes showed signs of slowing down. A considerable simulation of growth followed a return to a cooler climate which then continued in cycles according to the season. A maximum growth was then nosted in Juve and a minimum in Dear ber. The total nail growth was also retailed it is not the frequest and the seasor it was atoms seven in general definition with those observed dor the growth of the him.

ACLEMATIZATION OF THE INDIVIDUAL

The foregoing pages dealing with Heat Production and Heat Control and with Physiological Re ponses to Chimatic Heat indicate that hitle is known with certainly shout acclimatization

Lee (1923), has emphasized the complexity of the problem of physiological adaptation to climate heat. He believes that Failure of adaptation may be thermal circulators to concer analysic arms.

operate together. In a manus rept unpublished at this untime. Bull (941) and A survey of the contributions of Huntington. Peternen Mills and Price in the field of med cal china tology reven a alack of a recomment in some areas and undersected of a recomplains on the

effects of chinate on man
There is no longer any Coubt that excessive heat throns an increa ed burden upon
the heart. Failure of the circulatory mechanism to re-pond to the increased stress
incidental to exposure to heart is the principal cause of heat echanism to 1000?

Assument (1940) and that arctimatemation to huma thest apoless regulation of the circulation in gach a way that if can be keep at a practicusly normally cal when at rest or during note. If assumed that the eight increase of blood volume and the slightly higher pilot rate (observed by Forbes Dill and IIall 1940) were the cause factors darkpation. If small further, that circulatory future during note develops more readily in huma heat between of the dishiculture of heat dissipation and that the larger amount of blood demanded for circulations though the sake items of softeness the cardiac course.

It has been proved that northern Whites during continued exposure to heat ason deve on a marked increase in the secretion of sweat and that the percentage of sodium chloride climinated in the sweat because greatly reduced (p. 1991)

Alterations of body temperature Lesal metabolism and pulse rate which have been observed in certain individuals do not occur in other individuals

observed in certain marvascus to one occur included in the effects of chimatic heat are the very young and the elderly. Apparently the ponce of maint to regulate body temperature is comparatively to. This factor perhaps operates also in the elderly but the interprof cause of their susceptibility to beat is the decreased power of the

circulatory apparatus which is incidental to age (Shattuck and Hillerty 1933)

Drinker (1936) considered it safe to say that the effects of tropical relience are more pronounced in the children of northern Whites than they are in adults. In accordance with this view at has long been customary for the English living in India to end their of kidner of school age to Doghad However many white Americans is in girn the C nil Zone of Paisanse has enot sent their children sewy. The customary has the content of the content

Sex.—Women of northern races usually suffer more than do men from the effects of a period of residence m the tropics. Although physiological differences may play a part it is highly probable that compensative idleness and lack of exercise are of greater

nportance

Race—Rohanson Dill et al (1944) compared the responses to physical work of Wh te and of Negro share reoppers in the State of Messissipin dump the hot weather. Then the results showed that the capacity of the Whites for work under these circum stances was inferior to that of the Negro. The fact is as accord with the general belief that taxes on insting in the tropics a c better adapted to 1 fc there than are northern Writes.

The Negroes lost less we ght during work and showed a smaller rise in body temperature and less increase of heart rate than the Whites Moreover the haemoglobin of the Negroes was about nine tenths and the leucocyte count was about half that of the Whites The respiratory rate of the Negroes was more rapid than that of Whites

The acid base balance of erternal blood showed no dependence on race

The Ruto use busines or ternal most soowed no dependence on race.

For many years statistical information has shown a high incidence of heat effects among natives of the British like residing in India or in other hot countries. On the other hand the Dutch in Java and the North Americans in the Philippine Blands and in the American titopies unfer far less frequently from heat effects even though they take bittle presention aga art stropeure to hot sumplies. Although the French fars the sun nearly se much as the English they have suffered bittle from heat effects in their colonies in recent years (Statistick and Hildrity to other like the present of the sun nearly seems of the sun than the state of the sun than the state of the sun than the sum of the sun than the sum of t

Environment.—In the broad sense acclimatization requires not only physiological adaptation to climate but also bygenic and psychic adaptation to the environment Not enough is known as yet about these matters to enable one to determine in advance whether or not an individual from a temperate climate is thely to do well or ill in the

tropies A few indications may be mentioned however

Persone who have an ahoremally high basid metab ic rate abould avoid the Tropies. Those who do not sweat east yang villat respond with the increase of swe ting which is needed for the dissipation of beat. Habitual nervous teatability and lack of pose indicate that adaptation to life in a top cal environment it may be difficult. To make the necessary hypemic and psych cadoptations requires attong clearacter determ atton and knowledge.

E ivi onmental infl ences other than cl mate which may seriously impair the efficiency of white persons f om the temperate zones who have become residents of the

tiopics may be listed as follows

() Comparative social isolation and consequent paucity of intellectual stimuli

(2) Monotony of work

(3) Dearth of wholesome ecreation

(4) Unhygienic hving

(5) Depressing effects of di case

Infl ences numbered 1 2 and 3 have been discussed under Reactio 5 of the N roots System and number 4 has been death with in the section on Perso al Hygiene Acclimatization of the Solder—Singer (490) has described concisely certain tests

which he bed ves to be ag if and for determining the adaptability or ad plation of sold ers to charge s and I the methods us d for incre s ag the powert adapt t p nonunced changes of we there or of chimate.

Acclimatization to Altitude — Most of this symptoms which are experienced by per ons who ascend rapidly to altitudes of to ooo feet or more have been attributed by recent students of the subject to dimmashed by it all pre sure of oxygen and the conse16qS APPENDIX

quent imperfect aeration of the arterial blood. The more gradual the ascent the less decree of adaptation to altitude within a period of a week or less heys (1016) said that true acclimatization renewes several months

The frequency of mountain sickness in persons crossing the Andes is attributed to the rapidity of the ascent

COLONIZATION

The possibilities of colonization of the Tropics by the white races from the North have been the subject of much disagreement. The most important contribution is that of Price (1939) He attempted with considerable success to answer the following Why have white settlers in general failed in the tropics? Are they begin ning to make progress? Can they hope for ultimate success? He was very conscious of the complexity of the problem by virtue of the large number of causal or casual factors of possible significance. Especially significant for example are population derity or weight of numbers, the invariable presence of crossbreeding, the undercutting of advanced groups by groups who will accept lower hving standards and the political and economic pressures exerted by external peoples on the tropical whites

Price said that Mediterranean whites (Spanish Italians and Portuguese) react more favorably to tropical conditions than do northern Europeans and that they have survived to a greater extent. He reached the following supportant conclusions The white investors of the tropics seem to have shown that (2) white groups of northern or of Mediterranean origin can inhabit the moderate fromies and reproduce there for generations (2) in these regions Whites can engage in all types of labor and labor or ex reuse is essential for their health (s) almost all white settlers breed freely with peoples of lower cultural development. Consequently they tend to become absorbed where such peoples are sufficiently numerous (4) people who work harder and who accept lower standards of living tend to drive out groups that demand easier conditions of life (5) white people in the tropics have been much affected by factors such as disease diet

economic influences and political and economic policies

Whites have been more successful on the plateaus on continental margins in the trade wind belts and on islands than in the wet dry or in the low and humid parts of the tropics In the latter regions however prevailing diseases constitute a particularly serious obstacle. Price a book contains an extensive bibliography and also appendices by Robert C Stone in which he evaluated the physiological data bearing upon the sub rect of acclimatization

Castellant (1938) said that permanent columnation by the white race of the ion lying regions of the tropies where the chimsters equable hot and moust and where there is no cool season is not possible and that such a climate ultimately reduces resistance to disease and has a deleterious effect on the nervous system. On the other hand he believed that colonization of the highlands is possible if due regard is paid to sanitation

With regard to colonization of the northern part of Australia where the chimate is hot and relatively dry Cilento (1933) said that the conquest of climate is essentially the conquest of disease. This is an extreme opinion which is not widely held

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APPENDIX

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PERSONAL HYGIENE

Poreword—Information about the prevention and control of specific diseases can be found in the sections devoted to these diseases and an books desimg primarily with preventive including and public health. Luttle information is obtainable from these books bowever regarding personal byggene and prophylaxis for the individual. This subject therefore will be dealf with an the meaning pages.

PRELIMINARY PRECAUTIONS

Aledical Examination — Before making an extended visit to the Tropics it is advaable to have a medical examination to determine physical fitners. The presence of any serious circulatory disorder renders a visit to the tropics indivisible. Persons to afflicted should acropiclosuly a quid high altitudes whether on land at in the air. Other contraindications to be borne in mind are hyperthyroidism deficient weating of exposure to heat and disorders of digestion. Nervous or emotional restability is likely to be aggressed to a serious degree by proloned residence in the temptes.

to be aggravated to a scrious degree by prolonged residence in the tropics.

Dental Examination.—Because good dentists are scarce in the tropics the teeth
should be most carefully examined and treated if necessary before leaving home

Filings of doubtful durability should be replaced

Vaccination against smallpox and against typhoid fever including paratyphoid A and B is advisable unless, sich vaccinations have been performed within two years or the indivined its believed to be immune.

Auti typhus (p. 951) and anti yellow fever inoculations (p. 1674) have been advised for those who are likely to be exposed to these disea as . Because some reports show that vaccination against cholera (p. 633) usually becomes incellective after a year or even some months it is well to have it performed by the focal health services.

if and when an epidemic is encountered

Plague vaccuse (p. 701) confers a considerable degree of active immunity which may last for a year or more. The protection conferred by passive immunisation by means of an anti-plague scrain is of short duration. Local health services can usually be relied on to perform either of these unculations wherever plague prevails.

Equipment of special character which is important for bedth should be carefully selected and obtained before going to the Topinc * as means of protection against an analysis a mosquito net of suitable design and quality (p 1741) should be packed in a piece of luggage to the still always be available. Books or leggings for protecting the analysis from the tier of mosquitoes should be included (see p. 1743).

One or two canteens should be carried by persons who expect to travel much in the Tropics (see Water p. 1728)

A warm woollen overcoat u indispensable in parts of the Tropica where the eight may be cold or where the importance may fall rapidly. Light woollen cholung a woollen hatching and a wratter are valuable to prevent challing even where fluctuations of temperature are not extreme. This is so because exposure to heat renders one hyperensistic to moderate fluctuations of temperature. Cotton chings and beadgard suitable for ordinary west to the Tropics can usually be purchased there more cheaping than in the United States.

Food

Food in the tropics except in the best hotels as apt to be it appetizing or unwhole some Meats are usually very tough Soups and various other foods are often exces si elv greasy. Raw salad, and fru to which are not pealed at the table must usually be regarded as unsafe to eat and fru t of any kind may be scarce. Continuing heat seems to depress the digestive functions and it tends to promote diarrhoes or constination. In order to promote good digestion one should avoid eacessive fatigue eat slowly chew thoroughly ingest an adequate amount of fluid, and take physical exercise regularly

Diet.—The quantity and kind of food eaten by tropical races differs widely Many individuals among them are undernourished. It does not seem possible in the present state of knowledge to have ad ace to northern Whites upon any secure foundation Theoretical considerations suggest that the proportion of the heat producing foods which are ordinarily ingested to earhohydrate a d fats might advant geously be reduced when in a hot chimate and that meats could be taken freely. It is by no means clear that the total caloric intake should be decrea ed for any considerable length of time hecause the increase of body temperature which commonly occurs after exercise in hot weather increases met bohsm. Obese persons can well afford to lose some weight but others should ended o to maintain body weight approximately at the usual level. A diet of reduced caloric value may be adequate for sedentary workers Persons who e ercise much require abundant food

Whatever the diet in othe r spects it is essential that the accessory food factors such as grop and other mineral salts and the vit muns (p 030) should be ingested in abundance Fruits are important not only for their vitamin content but also because thry promote normal action of the bowels. If taken in excess they may cause diar thosa. If ghly speed foods may soon help to combat loss of appetite

M ik and Cream -In parts of the tropics no lesh milk is obtainable. The milk of cows goats huffaloes and e en of sheep may be used for drinking but reasonably clean milk is rarely available. Fresh milk or cream should therefore be boiled hefore use or at lea t efficiently pasteurized Pasteurization at 145 F to 150 F for 30 minutes does not kill all the bacteria but can be eled upon to destroy most of those that are pathogenic. After pasteurizing the milk should be cooled quickly to prevent the rapid

growth of surviving hacteria.

The accessory food facto s an milk except vitamin C are not much affected by pasteun ation. Precautions required for buttermill, or skimmed milk and milk to he made into a e cream are the same as for whole milk

Various brands of dried powdered milk are believed to be excellent substitutes for fresh milk. The powde ed milk should be dissolved in boiling water in a clean container and used soon thereafter. Unless to be used in quantity the dried milk should he packed in small time. Otherwise it is important to protect the unused portion from mo stu e and from insects by keeping it in a container which has a t ght cover

Powdered milk with suitable n odification can be recommended to infant feeding It has approximately the same food val es as pasteurized milk Because it contains little vitamin C (p x074) this vitamin must be provided from some other source

Butter made from unclean milk is a possible cause of tuberculosis or of other infectious diseases Butter is prepared howe or from pasteurized cream under sanitary con ditions in some parts of the tropics as elses here. When the cleanliness of locally prepared butter is in doubt canned butter or ole margan e may he used Canned butter of reliable brands probably contains most if not all of the vitamin A and provitamin originally present. If fortified by the add tion of vitamin D this vitamin also should be retained (Nutritive Aspects of Canned Toods 1937 p 36 and personal

letter) Oleoma garin s are of two types namely those which are made chiefly from vege table oils or fats and those which are derived from normal products. Most of the animal oleomargarines are devo d of vitamin A. To some brands however concentrates of vitamins A and D are added. Those which have been accepted by the Council no 1702 APPENDER

Foods and Nutrition of the American Medical Association provide not less than 750 USP mints of vitamin A per pound an amount which approximates the vitamin A content of an equal amount of good butter. Orang to a ruling of the Bureau of Amnal Industry of the United States Department of Agriculture oleomatyannes produced from animal fast may not be fortified with vitamin A. Therefore in the United States only oleomatyannes made from vegetable fasts can be so fortified. (Accepted Foods and their Nutritional Significance 1939 p. 40 and peetional letter.)

Cheese ... There is a great difference in cheeses with regard to their potentialities for carrying pathogenic organisms. The well ripened hard cheeses which have been stored

for from 6 months to 2 years are less likely to be dangerous than are those of the soft curd type. The latter are to be avoided wherever samitation is primitive

Fro en descereir stuch as toe cream and water soes a printing dangerous unless prepared from pasteurized milk or from pure water and clean fruit junces. The safest rule is to avoid frozen desserts except in places where the sanitary code is highly devel oped and well enforced. The subsect has been deals within detail by the United States.

Public Health Service (1940)

I extabler which have been thoroughly booled lose some of their vitamina. Acter theless because vegetables are likely to have been contammated they should not be eaten naw in the Tropics. This rule applies particularly to saidal made from me first vegetable to green used for gramming to celery and the like II has not been shown that such vegetables can be rendered safe by washing them in a weak solution of permanganate of portait. Tomatoes can be dipped into homing mater. The size quickly becomes loose and can then be petiod off easily. If it well to make the follest use of freeh native vegetables rather than to cal cannot deterable.

Fruits -- Tresh native fruits should be eaten freely I ruits growing near to the ground should be treated as vegetables. Those growing higher should be peeled. It is safer to peel the fruit at the table than to have it done in a kitchen where it may not be handled in a cleanly manner. Similarly fresh fruit juices or coconut mill may.

become contaminated if carelessly handled in the kitchen

Infant Feeding - Breast fed infants do well as a rule in the tropics and while there is no doubt that both mother and child benefit thereby each case must necessarily be judged on its ments and an analysis made of the mother a milk if the child does not three Harston states that the quality of the milk of European mothers compares very favorably with that of human milk in temperate chimates and quotes in support a table giving the results of analyses made in Manila of the milk of American nomen These analyses confirmed by Harston's observations abow that the proportion of proteid is less in nursing mothers in the fromes but that the percentage of fat is much higher On the other hand the results obtained by Jacob in Panama are not in agree ment with those in Mamla. He found that the milk of American nomen tended to deteriorate in quality as the infant's age increases and that the milk of colored nomen White women should nurse their children for at least two months but where this is impossible a wet nurse or artificial feeding must be employed. The greatest care must be taken in the selection of a net nurse. Both the nurse and her child must be examined for signs and symptoms of disease and this examination fortified by such laboratory tests as may be thought necessary including honever a blood test to every

Artificial Fedding—Ballfour states of course of good and pure cow a milk can be obtained from santiary dames shear at should be used distitled and weetened in the usual way. It is however comparatively rarely available and even when it is forthcoming samples should be carefully analysed for it frequently differs from the milk of cows in temperate chimates. It is usually more concentrated and the percentage of total old when the comparative of the concentration of the construction of the control of the comparative of the control of the control of the comparative of the control of the c

fodder and its milk under these conditions is quite palatable and can be humanized and used with advantage. All raw milk should of course be pasteurized.

Buffalo or caribou milk is unsuitable owing to its very high fat content

Decks in Panama obtained excellent results in maint feeding by using a milk composed of one part condensed milk to 4 or other parts of evaporated milk when distinct with seven to right or more parts of a zer. In the Ph hippines a miltimed milk one extende strended milk and cream has the case given good results. Canned milk hone ver must be treated as fresh cow a milk and be properly refragerated and protected from vertain when the cann are opened. Is fresh cann are required daily these methods have the disadvantage of being expensive. Direct milks are now emolowed to an increasant extent in the trongs. They are

Driver mixes are now employed to an increasing extent in the tropics. They are represent either by the rapid drying of fresh mixe to roller's heard by water or steam after which the milk solds are powdered a thor without the admixture of lectors or by the projection of milk in the form of a very fine apr y mto a closed room where the water is removed by currents of hot clean dry air caust ig the milk solds to fall to the

floor in the form of a fine dry powder

All dired milk intended for inflants food in the tropics must be picked in hermet, still yearded into H picked in the way the drud priparation will keep quiet as nell as too condensed milk. Blackham states that dumm the war some of the stocks of drud and milk were on hand a long it on earth other in the limitagins in 19, there were time of drud milk which must have been imported in 19, or carrier. The results obtained save evidence of the excellent keep no coulties of the brand of in d milk used.

A large number of samples of dred male ha c been extamined at the Lit for Institute of Preventine Wedgine with the result that in or acse c sulf the threefee half up to found at the result of a sense of septements by Blackb in no spore bearing organ issue serio found. Although the samples vere of a truly it sit is only organisms such many and the samples organisms which was not seriously the samples of the samples or the samples of the s

BEVERACES.

Water—Safe montepal water is not obtainable in many communities in the tropies. Except in the imallest places or in the interior bottled vater of a reliable brand is usually available. Water who has been bottled on the premises is likely to be unsafe for duraling. The rates plan is too bottled done they extraorded by Ere this purpose a large enamel ware kettle or a pot with a cover is useful. Preferably the purpose a large enamel ware kettle or a pot with a cover is useful. Preferably the port should he as a lip for pouring of Otherwise a falle with hooked handle can be useful. The lade should be kept hanging in the pot a he is the water is being bouled. Viter me it should be returned to the pot wathout have nallowed to touch anyth r

when traveling its amportant always to carry plenty of critising wate in ca teen. When traveling its amportant always to carry plenty of critising wate in ca teen. They can be filled with bookd water or the water in them can other containers. They can be filled with bookd water or the water in them can other can be always to carry the containers of the

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can not live in water. Probably it does not render a mochic cysts non viable. There fore, boiled water is to be preferred.

Drinking nater should not be filtered after boiling or put into earthen restels for cooling because filters and earthern sessels are difficult to keep clean. Filter pumps have serious disadvantages for use in the field. Firsh occomit milk stat times an extel lent substitute for water. Beer is less sufficiently for shaling thirst.

When sweating is profus the body may be in need of sodium chloride as well as water Under these conditions it is advisable to add about 10 grains (0 6 6m) of

table salt to each pant (about 500 cc) of drasking mater

It is little safer than the water from which it was made. Unless known to be clean it should not be allowed to come into direct contact with beverages or with food which is ready to serve.

Alcoholic beverages should be taken in great moderation if at all. An excellent rule is not to drink liquid to hot weather until after sundown. Neglect of this rule may not service infects from heat. For the sake not the diagention strong liquid should be nell dialeted below being consumed. Author water not see of doubtful purity ran safely be put into it. Cold dirink is referchange but seed drinks taken in hot weather sometimes cause indigestion. Beer as satisfying to some individuals but tends to increase theirs to others.

Most observes agree that an incre se of appetite and a stimulation of the digestive function frequently appears soon after armval in the tropics. This is eften followed even until in a boot time by a leastend desire for food of pearity animal food and a greater demand for spired articles of duct. The latter are represented by the curies of India and the child. of Neuron.

Manson Bahr has emphasized the special dangers in the tropics of over indulgence in food and drink beyond safe physiological limits and the tendency to the production

of tropical liver (see p 534)

REGIMEN

Habits of Life—In general habits of life have ratal or national characteristics and depend among cuitized people almost enterly upon tradition in respective of enzyron ment though tradition in its early stages arises from a lengthy adaptation to special uncumatances. Therefore while the habits of the hin natives of a country are generally more or less well adapted to the conditions of the clumate and to the stage of crivitation at which the arch has attend the habits of the white races are adapted to the temperate repross from which they come and necessarily must be adjusted to this new conditions in lithius make environment unless environments is permitted to regulate habits come quently the circumstances and conditions induced by persisten as in highest consequently the circumstances and conditions induced by persisten as in highest consequently the circumstances and conditions induced by persisten as in highest consequently the circumstances and conditions induced by persisten as in highest consequently the circumstances and conditions induced by persisten and most for the conditions of control of the condition of the condit

Exercit — A certain amount of systemat. Stally exercise to the open air adjusted to the sign and physical condition of the undividual is essential for the maintenance of good health in the frequest. If promotes sleep and rest strondates persistant sheeby assuting the body to expell effect matter and or become any tendency to construction. The concomitant perspiration leads to greater excretion of organic matter by the secting almost and the more rapid respiration to more thousuph action of the body. Exercise properly taken improves the appetite and capacity for work and materially leasest arribating of the extent already system. New arrivals simulated they are underly formed and the properties are considered and the properties of the properties and the properties of the prope

mo otony It is a mistake to play tenn s in the hot sun or to seek a rapid coat of tan by an unduly prolonged expo ure to the sun s rays Care must be taken to avoid chill after exercise. When possible a warm bath should be taken immediately followed by a cool shower and a vigorous rub down and a change of clothes otherwise protection from chilling may be afforded by a sweater or other suitable gar nent

Hork and Rest -Cilento (1925) stated that experiments in New Guinea hoth with white men and with natives, demonstrated that the quality and quantity of work done between the hours of 6 a m and 2 p m co siderably exceeded in both respects that done during any other set of hours no matter where chosen In most tropical countries work ceases between the hours of 11 a m or 2 Noon and 2 or 3 p m the usual interval of two hours heing devoted to lunch and rest. The daily work period from 7 a m-5 pm with two hours rest from 11 a m to 1 pm was observed during the construction of the Panama Canal apparently without deleterious effects upon the workers who for the most part were eng ged in hard physical labor. According to Cilento this routine is well intentioned but faultily conceived the rest period serving to accentuate the feeling of 1 stude on the part of the workers Production and contentment will undoubtedly be increased if the wo L is finished at 2 pm so that the worker may indulge in rest or evergise or both during the remainder of the day

Most people need at least eight hou s of unbroken sleep at night in the tropics Some prefer to sleep on a veranda protected f om mosquitoes by a thorough acreening or by a bed net Sundstroem from observations in Townsville found that the bed net reduced the already poor cool ng power by one third At the time of the experiment the bed without the net would have offered a tolerable cooling power for a resting person After drawing the net this was impossible. In a few experiments when comparing a bed on the verands with one indoor it was found that the bed with drawn net on the verands offered the same roof no power as the bed without net indoors. And yet people continue to sleep indoors. If work bega a early late hours should be avoided for as Balfour states they tend to produce ansomnia and the latter often heralds a bre kdown The mid-day siests is commonly observed by most tropical peoples but the more energetic Anglo Saxon may d spense with it entirely. It is very necessary for white women if they are to preserve their looks and vitality and i r white children

Bathing -Frequent da ly bathing for obvious reasons is both desirable and necessary in the trories Tepid or warm b the are to be preferred both because of better cleansing p operties and to av d chills. In the case of those who he had malaria and in whom the disease has not been entirely enadicated a rel pa a likely to follow a cold bath Strong healthy people often derive be efit from a cool she r after a warm bath as it removes the feeling of lassitude sometimes 1 d ced by a warm bath. Cold bathing is not recommended for infants childr n debilitated old people Balfour states that shaving the sxillae a native custom in many parts of the t opics would not only tend tot ands comfort but prevent the risk of contract g those fungus diseases so common

in the tropics

-Putrefactive and fermentative processes are more common and active in the tropics a d infections of the alveolar mucous membrane frequently occur in persons who do not give sufficient care to the teeth. Accumulations of tartar on the teeth irritate the gums and frequently lead to serious dental infections which timely removal would have effectually prevented. As carres progresses rapidly all cavities should receive immediate and appropriate dental treatment. It has been said that a clean tooth never decay The te th should be the oughly a d properly cleansed twice a day with a tooth brush f only moderate ha diess and hrushed alo g the axis of the tooth from the gum margin to rd the free surf ce and not cro swise as the latter cau es an irritation of the gums and may event ally cause them to recede thus e posing the roots Material lodged in the inte st ces between the teeth should be removed by the a d of dental floss. The teeth are part of a skeletal system that is susceptible to aly fe ture which seems t be of definite etiologic sign ficance in preventing decay is a diet composed largely if fruits and vegetables and concluded that heredity infectious diseases and the care of the teeth appear t be of little if any significance

1704 APPENDEX

can not live in water Probably it does not render amoebic cysts non viable. There

fore boiled water is to be preferred

Draking water should not be filtered after boiling or put into earthen vessels for cooling because filters and earthern vessels are difficult to keep clean. Filter pumps have serous disadvantages for use in the field. Fresh occomut milk as at times an excel leant substitute for water. Here is less satisfactory for ablating thirs?

When sweating is profuse the body may be in need of sodium chloride as well as water. Under these conditions at is advanable to add about 10 grains (6.6 Gm) of

table salt to each pint (about 500 cc) of drinking nater

Ice is little saler than the water from which it was made. Unless known to be clean it should not be allowed to come into direct contact with beverages or with food which it ready to serve.

Alcoholic beverages should be taken in great moderation if at all. An excellent rule is not to dural leignor in hot weather until after sundown. Neglect of this rule may notife expose affects from heat. To or the sake of the diagestion, strong liquory should be well diluted before being consumed. Neither water nor ric of doubtful purity can safely be put into it. A cold dural in effecting bett need drains taken in hot weather sometimes cause indigestion. Beer is satisfying to some individuals but tends to excess these in others.

Most observers agree that an increase of appetite and a stimulation of the digestive function frequently appears soon after armval in the tropics. This is often followed even within a first time by a lessend desire for food experisilly animal food and a greater demand for speed articles of diet. The latter are represented by the curries of India and the following the forms of India and the following the following the following the following the India and the following the following the India and the following the following the India and the following the India and the following the India and the following the India and the following the India and the following the India and the India and the India and the India and India and the India and India

Manson Bahr has emphasized the special dangers in the tropics of over indulgence in food and drink beyond axie physiological limits and the tendency to the production

of tropical liver (see p 521)

RECINEY

Habits of Life -In general habits of life have racial or national characteristics and depend among civilized people almost entirely upon tradition prespective of environ ment though tradition in its early stages arises from a lengthy adaptation to special circumstances Therefore while the habits of the natives of a country are generally more or less well adapted to the conditions of the climate and to the stage of civilization as which the race has arrived the habits of the white races are adapted to the temperate regions from which they come and necessarily must be adjusted to the new conditions Habits make environment unless environment is permitted to regulate habits conse quently the circumstances and conditions induced by persistence in habits unsuited to the climate are among the chief and outstanding causes of the discomforts and dangers of tropical residence Moreover there is the feeling among new arrivals which is only corrected by experience that the precautions taken or the habits of life observed by the older residents are trivial unjustified or absurd. Climatic adaptation is essential and must be assisted by correct liabits and the accentance of environmental circum stances which are in conformity with the existing conditions of chimate and temperature

Exercise—A certain amount of systematic duly exercise in the open air adjusted to the age and physical condition of the individual is exercise for the maintenance of good builth in the tropics. It promotes sleep and rest simulates persistains thereby assuming the body to expel effect matter and werecome any tendency to constitution. The concentration of the concentration is a strength of the contract of the contract and were considered and the strength of the contract and expective of the contract and expective of the contract and expective of the contract and expectity for work, and matter the contract and expectity for work, and matter charge of a contract and expectity of the contract and the contract and expectity for the contract and expectity of the contract and expectity of the contract and expectity of the contract and expectity of the contract and expectity of the contract and expectity of the contract and expectity of the contract and expectity of the contract and expectity of the contract and expectity of the contract and expectity of the contract and expectition of the votal forces rather than beneficial effects. Describe forms of exercise such as walking swimming radiug tennis golf and beating should be taken in the early morning of last difference must not be overefined and should be totated to prevent.

comment or invites pity or makes the patients at least a centre of passing interest are attributed to an irresistible mental demand for recognition. To this also must be attributed the excessive and uncontrolled outbursts of passion they suffer when by the thwarting of some whim or the contradiction of some expressed opinion the inferiority complex under which they labor is called suddenly to the horder of consciousness Second only to the will to personal survival and closely related to it is the desire to create and whether the is effected by actual procreation or by the consummation of some wo k that holds the dominant interest of its possessor or hy hoth it alone can satisfy the universal and imperative demand for self fulfilment

If such a demand is persistently foiled up to the point at which demal seems final the mental tension increases to and beyond the maximum of mental resiliency and the breakin strain is represented by over reaction to stimuli by intervals of alternating despondency and excitement and finally by that irresponsibility eccentricity and lack of concentration known as neurasthenia. At that stage whether the patient resides at the equator or at the poles or anywhere intermediate unless something sufficiently strong attaches the interest neurasthema must inevitably supervene

Unnatural Life for II omen - If the life of the ordinary woman in the tronies where there are subject native races a examined at is obvious that her creative interest in a very considerable proportion of cases will find no expression whatever in any of the three ways which are most common namely in ber children in her home or in her outside interests. Many women coming to the tropics refuse to have children having been persuaded it is a dangerous and maybe a fatal proceeding. Those that do have them often leave them to the care of a native nurse almost exclusively. Frequently they are persuaded that they are unable to purse the child, and cease to stand in an intimate parental relationship, as would result from the care and nourishment of their own child Many hereave themselves of their children at their most engaging age by sending them out of the country

In many places it is considered undiscussed for the white woman to attend personally to any of the duties of the household and these are left entirely in the charge of house

hoys of whose native tongue she is probably almost entirely ignorant

As outside interests are few and in sal the one outstanding characteristic of tropical society becomes its lack of communal interests and this very lack produces a state of mutual misunderstand g which tends to embitter the few social relationships which are p saible The great deficienc es are lack of interest and lack of physical exercise. If a family is not dependent for peace of mind upon outside social influences and finds contentment n its own family life there is no reason to believe that mental or nervous conditions will develop among the members even during the comparative isolation in period of excessive ainfall. With unmarried per one the problem is more difficult

PROPHYLACTIC MEASURES

Exposure to Sun -The requisites for protection from the sun will be discussed under Clothing (p 7) and Headgear (p 1712) Megaw (1030) who was thoroughly familiar with cond tions in India whe e the sun is greatly feared has well s d that the sun s rays in the tropics have n mysterious pr pe fies and that the ser ou harm which may result from them is an effect of he t (see Acute Effects of Heat p o82)

Exposure to Cold - Chilling is to be avoided especially hy th se who have h d d who may not be entirely f ee f om the disease Megaw (1939) h wever hel eves that the healthy body should b able to accomodat itself to moderate changes of temperature and that maintenance of full gor requires expos re to such changes Hence the dehility which commonly de el ps in persons who a e exposed fo lo g periods to an equ ble cl mate that thenzed by high temperature and humid by

The methods of p ophylaxis against imp it a t diseases are described in the sections devoted to these diseases or in that on a station. A few other matters which may not ha e heen covered are ment oned below

Food Poisoning -Putrefacts e changes take place more read ly in all foods espe cially sea foods a d toxin p oducing bacte ag v more rap dly in foods such as meats,

Recreation is essential for the maintenance of mental and emotional normality Spotts games intellectual pursuits and hobbes should therefore be encouraged

To escape from one a semotions is not possible. Carthew stated that the mo i important thing is to learn how to judge the emotions how to value them how to divert them into harmless or better still into useful channels and this is what should be taught to the prospective wanderer before he ventures into the tropics. Sublimation or canalization is the process by which instinctive emotions are directly from their original ends and redirected to purposes statifying to the individual and of value to the community.

A curasthema — Mental irritability and nervous breakdown in the tropics which in the absence of demonstrable organic lesions are commonly regarded as due to climate are frequently included in the term, tropical neurosthemic for lack of a better term.

Crumpston has called most of the neurasthema of North Australia kitchen neurasthema. Plehn has referred to outburst of passon as tropical frenzy and Sir Hase clock Charles has described similar neurasthema manifestations characterized by shortness of temper forgetfulness sleeplessness and disinclination to work under the title. Pumba beard.

The real cause of these nervous manifestations can undoubtrolly be traced in most instances to faulty habits of life such as overfeeding poor elimination lack of estress faulty daily routine excesses the absence of any cerative interest work or hobby unhygen: surroundings endoerine disturbances and the depression of previous or concomitant parastic infections. All physical agents such as best light humidity winds and glare are merely agravating factors and not the primary cause which is essentially newholorical in character.

Wyborn states that a person removed from his native surroundings to which his mentality is adjusted to a new environment whether tropical or polar will suffer until new and mentally satisfactory associations and mental adjustments have been made. Depending upon the mental development of the individual even from infancy

this change may or may not occur

A tendency to forget names and an anability to recall immediately familiar timids details at will a common defect among teppolar residents as foreign expensive to face of exercise and disappears when adopaste exercise is taken. Hinter points out that although all women can be in the tropics of they her rationally those who are poor and so are forced to work hard do uncommonly better than those for whom everything is done.

TYPES OF TROPICAL NEURASTRENIA -Apart from that due to definite organic cause neurasthenia as observed in the tropics is of to types The one type is due to indolence and self indulgence and the other to the depressing monotony of hard work under unfavorable circumstances Cilento states that an instability of the mental equi librium is manifested by fits of expherance alternating with states of depression Unwarranted irritability over trivial matters is a leading early symptom and even blasts of fury are not uncommon especially with male patients. A lack of self confidence is often a prominent underlying cause and is associated with a diminution of mental ability activity and the power of concentration. An unresponsive memory added to these disabilities greatly diminishes the working capacity. The realization of this mental state by the patients and their futile attempts at readjustment produce even greater lack of self-confidence and an aggravation of the entire syndrome As noted by Cook in old residents of Uganda nervous umability is shown by a response to small stimuli increased reflexes tachycardia and insomnia. Dreams of a depressing or a terrifying nature are frequent symptoms which upon analysis show most definitely some complex hased on the non-creative monotony of the life of the individual some apparently great failure to adapt themselves to the circumstances of life as they are White persons in the tropics and natives following the daily routine of trivial

clerkships together with the neurasthenics of temperate climates are all alike victims to that craving for self-expression that their vocations deny them. They are fixed in circumstances to which they cannot adapt themselves mentally and their eccentre actions are evidence of their revolt. The ostentation and invalidism that attracts

	C		C
Black thin lining Black cotton serge Black woolen serge Blue dark cotton Khaki heavy washed Khaki beavy new Khaki wool serge Surrounding air	83 9 83 B 79 2 70 0	Abakı solaro Abakı wool cord Abakı thin Biae pale old cotton White duck knen White duil washed cotton White duil new	72 9 72 8 72 3 73 2 61 9 59 5

Thus a hists it the coolest color and light blue a color commonly used in gainnests of the Chinese cooles and Egyptian laborers compares far rally with khalt. While integer tures in the sun depend upon the color exposed they are also influen ed by sur fee texture and the rate as who heat as loss thy convertion. The differences in temperature noted with the various hinds of khalt ere thought to be du to differe ces of color as some of the test precess were of a distinctify lighter color than others. The Solare and similar fabries which were used extense sty. I the time the actuar ray theory was regarded as of paramount importance do not appear to afferd protection superior to that of thin khalt. Practically no difference in th temperature is an observed when lagers of a thin color we of parts.

An attent e riprement in the daily use of orange red undernear by 500 men which was cond cettor in the Philippones was reported by Phalen in 190. An exqual number of men warms, white undernear nete ob erved at the same time as controls. His con clusions were that the slightly beavier orange red undernear added materially to the burden of heat upon the system which is undoubtedly the great cause of tropical deterrontion. To balance this it is protective against the chemic large the influence of which is regarded as of tittle moment as d which is sufficiently excluded by hishis tree of the control of

Maters Is - Art cles of clothing hold moisture either: the f rm f droplets between the f bers or by absorption of the water by the fibers Ammal fibers absorb more water than do plant fibers Wet fibers s ell and thus tend to occlude the inte stural spaces On the other hand water held in the interstices occlude these spaces even more. Cotton fabrics have a greater tendency than woolen to stick to the body when et is a dis dvantage because I occludes the air space which should sist between the clothing and the body. Wool est equally when loosely oven appears to be the only fabric v hich still permits when saturated the passage of air between the fibers interpos d layer of a pre ents too rap d evaporation of vater from woolen underwear and chilling of the body by rapid evaporation from woolen outer garments. The hygroscopic power of wool teads to keep unde garments of other materials d v as e idenced by the p ctice among solds rs of a earing woolen over rotton socks during long marches in hot we ther Wo lea materials however are less cle uly than cotton silk or linen. They show the out and signs of dirt less but tend to shri k on washing a d often irritate the skin when worn next to it. With the exception of the woolen vershirt and socks for active work r the open and light mering and rwear for child en and debilitated p rooms dury z the coole months white or hight colored cotton lines or silk will be found more comf rtable in the tropics. Linea is more durable, weight for weight than cotton and because of the smoothness of its fibers a ils less re dily

It is als as d to be cooler and more absorbeat than c tim.

The best interests of hyg: en the t pacs are served by clothing that can not only be readily and repeatedly washed but that can also be sterilized or disinfected by boil

1710 APPENDEX

communicable skin diseases are popularly called dhobie or washerman sitch. Pri wate individuals or families should if possible insist upon the attendance of the washer man instead of allowing him to take clothing away.

CLOTHING

Types of Clothing —When selecting clothing it is important to bear in mind that free ventulation of the skin is essential to promote cooling by evaporation of perspiration and that dissipation of heat from the skin takes place more rapidly from uncovered parts of the body

In a hot equable chmate all gatments should be loose thin and fight in weight. The shirt should be worn open at the neck and the sleeves should be short. Instead it rousers. Megaw (1933) advance cottom, shorts which are buttened to the short to render the use of a belt unnecessary. Shorts are not suitable when protection is needed from inserts or from letters or in a reas where a phassions of lees may occur.

When a coat must be worn suspenders may be more confortable than a belt Longitudinal slits under the arms of shart and coat promote ventilation and are visible only when the arms are raised. Cotton suits for use in the hotter parts of the troptes should be made of very light material. Even so a heavily starched suit is impervous to ar. It has been suggested that those who do not pensyin reportly need sur no underclothing. Honever undercichings spreferable. It should be of light and porous material which will show the necessariation and permit it to exponent extractions.

material which will absorb the perspiration and permit it to evaporate gradually.

The type of clothing to be won by either sex may require modifications for protection from insect lates. Other modifications are required wherever sudden or considerable changes of temperature occur. Under these conditions a sifeculess sevare or a light overcost should be at hand. Lightly movem woollen is preferable for outer clothing.

n here the diurnal range of temperature is considerable.

After prolonged exposure to constant heat the body becomes extremely sensitive to changes of temperature. A drop of more than 10 F produces a disagreeable sensation of cold and unless warmer clothing is put on promptly a further drop may cause

chiling and an attack of diarrhora

Spine pads are useless. Cholera belta have the disadvantage that they may
become soaked with perspiration and thus increase the chances of chiling the abdomen

They tend all o to induce prickly heat.

Color—White will generally aboorh the smallest amount of radiated energy bit.

Wood has shown that ultra works he'ds is not reflected from all white surfaces as the streated with simple outle or Chinese white appear abled when photographed by the high.

The following table compiled by Rubner gaves the absorptive powers of different colored feetings materials commerced with white as 1 oo o

		Dark green 1 61
Light yellow	1 02	Red r 68
Light green		Light broxu 198
Dark yellow	1 40	Black 2 08

It will be noted that black can absorb over twice as much best as white. Experiences with orbits by Colob Arive demonstrated the supernorty of the protective solution of white over the darker colors. Whate gray and black rabbits were exposed at the same time to the sum in Manila under adealized conditions. The black rabbits ded in thirty three manufact the gray in one hour and thirty two manutes whate the white rabbits recovered after the same exposure to the sam as excelled the gray.

Fabres of various colors and weaves were exposed to the mid-day sun by Grabham at khartoum in 1918 on bright still days with thermometers inserted so that the bulbs were covered by a single thekeness and separated from the support by at least five layers of the same clotb. The following temperatures the mean of three experiments were recorded:

To protect the ankles from mosquitoes in the evening close fitting white leggings are desirable both for men or owners. Men can wear them under a pair of white trousers. The lower end of the le $_{\rm loo}$ should lap over the white shoes like a spat

leaving no opportunity for mosquitoes to bite the feet

Best: Shors and Seals—Low whate canvess shors are perhaps the no t comfortable foot wear for the tropers with white buckstan net! Outside of settled communities however high shore with legg; go or putters or boot are essential. The best results a coltanced by fittin, boot or at severe a tuck, pan of socks to allow for the swelling of the (et which is ausociated at high exception and for their expansion during long walks or exercise. Comfort is meressed by foot wear not too tight over the matter with privary of room for the toes and with plable soles. The tendency of the skin to more than the contraction and the pre alresse of all an indeconservation of the pre alresse of all an indeconservation of the pre alresse of all an indeconserved to the tendency of the skin to more than the contraction of the present of the present of the contraction of the contract

The long more, unto hoot made f thm whate cawas or of light soft leather is very comfortable for even gases. It protects the saille completely from monquitors $\mathbb{B} \circ e \circ Cf$ if g—Fashons est the style and cut of the dothes in all local tres Sundstrome pointed out that the whate woman as well as the white man axis can unner easily clothing a large reserve cooling p we. With proper cloths g this cooling power when added to that constantly a large would greatly improve the best eliminations e on to the point at which as any of the eccondary and probably harmful tropical weaking the cooling power when added in a single cooling to the cooling power when added in sea indicated for wome α the tropic α Life weight cotton and have materials are said to be cooler than it. Well constructed white parasols p of earthly lined with green α life found most agreeable to both the eyes and the uncovered reshly lined with green α life found most agreeable to both the eyes and the uncovered α .

skin when exposed to the sun durin the hottest part of the day

Ci id en a Clothing -Care must be taken to po ide timely a d proper changes of clothing as children ar e y susceptible to variations in temperatu e. In ge eral loose fittin garments allo mg free circulation of a r and made of material both absorb e t and porous are necessary. Infant require the year ou d underwest of silk or muxtures of silk o cotton and ool varying only in thickne to suit the sesson. Long clothes are generally condemned by all authorities Waterproof fabrics may be used to pr tect children's mattres s but they cause arritation of the kin must never be placed over an infant s n pkin. One piece play suits of khaki or light hlue with loosely noven nameook combination u derwea to pe ent co striction at the wast and irrita tion of the skin re ide I dur g the hot weather Most auth rt a however bel eve th t unde w ar of light flannel which in add to to h n warm is h th ab orbent and porous is preferable d m g the c oler weather and throughout the rai y seas n A nightgov n f thin flannel with a running tape at the bottom for fants and one percentage of the percentage of the flants and one percentage of the percentag pajam s or knitted sleep g s ts s ch s the Arnold s fo older children will prevent exp sure of the skin at night with it attendant da g r of chill. To prevent hook orm shoes must be worn in all countries wher the disease is endemic. Sandals have been recommended but it is doubtful if they protect the feet as well a shoes

recommensue uses in a congunut is easy prof ct for it is well. It is the made with Rain Chiler — Trippeal conditions reque (what waterproof clothing he made with seams essentied and sit bed as rubb r cement tends to soften in the heat. While all r in clothes are both to po he or water poof cepe affords better well atoms and in probably the most comif it be. O thrawy i hore was be water proceed by immers on a solution of few counces of 1 of no wool if it do slowed in a gailst not perform that we have the solvent of the solution in their removed and the articles dried in a curre tof ir. Gar mental tends to this process which in described by Lakiss and Elickhaim are said to mental from their my depth and perform the solution in the condition of the solution in the condition of the solution is the condition of the solution of the solution of the solution is the solution of the solution

ing Parasitic skin diseases are very prevalent in the tropics and it is regarded as next to impossible to cure those cau ed by moulds ar mites without thorough and repeated distinction of all disting an contact with the infected skin

Cotton is comparatively cheap fairly durable may be obtained in any color or seight and is perhaps the best available material for both underwear and outer gar ments. The experiments in the Philippines would seem to indicate that ultra volet rays are largely stopped by the garments exposed to the sun and that white cotton under wear will amply protect the skin from such rays as may possibly filter through. As clothes tend to betome more easily souled through increased perspiration many more changes are required than in temperate chimates. What is the color of choice but where the nature of the work precludes this color the lack of laundry facilities of the cost of washing would be probabitive khali or similar material may be substituted.

Siks such as taffetan mercented cotton leather and rubber materials do not terp well in the typics. White cotton and him articles such as wheta and table delth when stored outside of a dry room tend to become sported with moulds and rust stains due to a furgue. It has been shown that many of the air borne fung are either kilded or inhibited in their growth by a blorial application of formaldehyde. Consequently spraking formaldehyd one bedding and table hane or the interposition of paraformalle hyde tablets incased in small gaute sacks will prevent or reduce to a large extent the development of these moulds, comblesome finms the vision out of the housekeeps.

Headgear -An excellent substitute for an umbrella or the crude and cumbersome hats of native workmanship as a helmet with a large brim which will shade the neck The protection accorded by the pith helmet depends upon its light color the low con ductivity of the pith crown and the provision made for free ventilation. The heavy helmets frequently seen in the tropics cause fatigue of the head and neck helmet withstands rain but it is heavier and less cool than the pith helmet. The maximum of comfort and protection will be provided by a helmet which is white in color light in weight and constructed to allow free circulation of air Ventilation is obtained by openings at the top of the bead piece and an air space formed by the insertion of cork disks between the head band and the inner walls of the helmet. Protection for the pith helmet against rain may be secured by a removable naterproof cover Corson found that with a maximum shade temperature of 86 to 88 F and a fairly atrong breeze the felt hat and the red fez showed temperatures within the hats of from 105 to 112 I with exposures of from ro minutes to half an hour or longer ladies felt hats 108 F white pith helmets 97 to 98 f Panama straw bats rarely showed temperatures above soo F After wearing a Panama hat for a year in tropical Africa he preferred it to the heavier Wolseley helmet which he had worn previously

Africa he preferred at to the heavier Wojseley belimet a bird be had worn previously I have known adults who could go bare headed and unharmed in Indo China in the Belgian Congo and in the Amazon basin Ooe of them was almost completely bald

In Panamia, very little care is taken to protect the bead and neck against the und At the what schools in Bilboa and other towns on the Isibusus the hair is said to be the exception rather than the rule. The practice is observed largely by children and young addits and apparently is microsing during the summer in the United States Acting upon the belief that the sun has no power to produce damage by direct exposure and that the life-flects resulting from strong sample are due to the action of the glare upon the eyes many walk about in the un with the eyes protected by dark glasses of dark eye shodes but unprovided with hairs and apparently suffer no ill-effects.

Certain individuals and among them most of those who have experienced heat pyrena are extremely sensitive to hot similight which falls upon the head or upon the neck. They may neverthele s obtain adequate protection in the tropics by wearing a good belimet.

I grow a proper property of the sum of the project the anhles from mascis the can use legging is comfortable and restorably adequate. The spiral wookles putter bas many di adentages and the leather putter is needledly heavy. If the legging is to be used for riding the learner should I ad through the cyclets instead of being bedd in place by blooks which catch on the sturpe

should be protected by a ceiling and the intervening air space well ventilated. A thatched roof has the advantage of coolness but it harbors insects and other pests. In most tenned, countries the accordance in addition to propuling shade and pro-

In many tropical countries the verandas in addition to providing shade and protecting the house proper from sun and rain are used as living rooms as they are open

to the breeze

To promote comfort verandas should be much larger and more extens ve in propor ton to the house than in temperate channets. A veranda should be but into only its provide shade but to act as a shoft to assist in the circulation of air. Frequently they are too enclosed to serve this purpose and hot air banks against the side of the house has deep layer which warms the adjacent rooms. The word the accumulation of bot air verandas should be double roofed and the interacrace should be well eventuated

Metrods—Aside from the native thatch or hamboo build rigs may be constructed of mind wood smod-fred herk burst back since and conce ret. Graham conducted experiments in 1974 with building bricks. A hole as drilled from the end so that the hulb of an a serted thermometer was about the center of the brink. A pair of burnt bricks and a pair of sun-dried bricks were used. One of each pair was white washed while the other was left plain. They were then exposed to the sum for two consecutive days. The readings of the thermometers at a pin were as follows.

Material	February 9 2 p m	February 10 2 pm
Plam burnt brick Plam aun-dried brick Mud brick whitewashed Burnt brick whitewashed Official maximum	57 & C 54 3 49 3 48 3 33 4	53 3 C 50 4 46 9 46 3 3 1

He concluded that the texture probably contributed to the difference in favor of the sua-dried brick

In Panama very satisfactory types of one and two story dwellings were built of wood d mig the early days of can I c naturation. They conformed in general to the burgalow pattern and b d wide verandas on three and n some instances on four adds which were equipped with either single or double screened doors. These doors always opened outward to prevent the angress of mosquitors and other insects when they were opened. Chamberlan states that it is particularly important that is undoor about the either of the French sis segment type or che side into the wall in order to permit its low of the control of the real side of the sid

Houses hult of concrete have great advantage over wood in that they are perma nent cannot be harmed by white ants (termites) are less likely to become infested with

ordinary ants and cockr ches and are more easily rat proofed

In some recently constructed buildings— the Canal Zone Chamberlain found that it was entirely practicable to make all the concerts members very small and by thus almost eliminating the wall ery free ventilation was secured. Sufficient overhang on exhibitory was provided to level out then as we short over un the fathmus and which was the contract of

Col r — Grabham conducted experiments at Wady Halfa in 1921 with flasks painted with colors in common use. White and black atts dards were provided. The white flask was treated with a lime ash which gave a white mat surface and the black stand ard flask was coated with a mixture of lamp black and a graish which dired with a dult.

black surface The results of the experiments are shown in the following table

THE TROPICAL HABITATION

Housing.—The primitive house as exemplified by many native hits is c entaily a one roomed enclosure provided with a roof. Larger houses are collections of such primitive rooms arranged more or less in accroadance with custom confort and convenience. In the tropies, the objects to be attained in building, construction and convenience. In the tropies, the objects to be attained in building, construction are disposed to the attained and the intervisions and to exclude the greatest amount of heat. The kind of house to be built will depend upon the architectural customs or styles and upon the environmental conditions.

There are two general types one of which may be called the bungalow pattern and the other the Spanish type of house. The first type a characterized by wale scenaris broad passages the largest possible amount of a undow space and the elevation of the structure two to three feets above the ground on mooden or preferably concrete posts to permut free cutalistic of all presents the course. The rooms are arranged in a single

row one room in depth so fer as possible to facilitate the free passing of the breeze. Elevation of the structure on posts either wood crossored wood concrete bink or stone is a very great advantage and if sufficiently high will provide utilizable space beneath the house. White paint or even white wash applied to the under surface of the floring even though the space is not utilized is an advantage as it trinds to prevent the harboring of mosquitoes which prefer dark windle a shelters. All posts should be equipped with a retter for sole or other suitable or creataints.

The second type is of massive construction is those verandas but in thick walls and bull about a central court or pate. High varon whitteed incidens are provided which are kept closed during the day to exclude both heat and light! Cookies of the ottack walls which in the old Spanish bases was obtained through theirs may also be provided for by double concrete walls properly at proofed containing an espace. Violent hollow building title hould be very effective in this type of hour the Spanish type seems best adapted to hot inland coins while the bungalo itype is more favored and prehasis before adapted for build could also the bungalo itype is more favored and prehasis before adapted for build could also.

Damp roof courses of slate glased or vell tarred brick sheet lend tile or other impermeable material must be inserted horizontally through the entire thickness to

prevent moisture from rising in the walls

Lo atom —From the standpoint of health the primary considerations in the air for a duelling are its location with reference to prevaiting winds mosquito and fly producing areas and notice populations. The opportunities for a good water and food apply and the proper disposal of cereat and refuse of cour a require consideration.

The situation should have a cheerful outlook and be ele ated preferably on a slope with good natural drainage. Sandy of gravelly soil bears weight well and is said to be the best. Clay tends to hrank or swell with changes in the weather and to tause cracks in buildings placed upon it. Soil with a constant level of ground water is prelerable to that in which the subsoil I afer varies with the scason. The ground water should be o to 8 feet below the surface. A site to windward of swamp and native com munities will reduce the number of mosquitoes. Anopheline mosquitoes instinctively By toward a light and are capable of flights over a distante of a miles or more. A stretch of open water a mule in width does not oppose an effective barrier. During the construction of the Panama Canal it was the practice to remove vegetation and keep the grast closely cut for a radius of 100 yards about white settlements to prevent mosquitoes finding shelter during the day While this is not ordinardy practicable it is well to keen grass near a d elling cut and ayoud mass a of vegetation in lands are gardening Vines about a seranda reduce ventilation and afford resting places for mosqu toes The house should be so placed as to obtain the greatest advartage from the pre ailing winds Balfour recommends that the building be oriented to face north and south

Rools may be either pealed or flat but the flat not is some chat hotter than the former. In either case conferes can be enhanced by a double roof with an interspire connected; with the outer air to provide ventilation. Thereigh screening of all openings is necessary to prevent the estrance of basis and rats. Calvanized iron roofs are very ton draming the day but toge keet a rangely at a ght. When this mater a is used the rooms.

(3) Roof spaces should be examined at intervals with a lantern

(4) Dead timber should be removed from the v cinity of huildings. An old stump or a negl cted heap of firewood encourages white auts. Pieces of timber left leaning against a wall may enable whit, and it oenter (5) If white ants are found up, building, no time should be lost in dealing with them

The tunnels should be broken away as far as they can be reached and white ant solution applied freely to them and to the surrounding wood. The extent of infestation should be traced out and care taken that no other means of access is left.

(6) Posts attacked by white ants may be treated by borning an augur hole d agonally

(o) Fosts attacked by white ants may be treated ny boring an augur hole of agonally downwards filing it with b white and solution and refiling no slon, as the solution soaks into the wood. When full of the solution the bole may then be closed with a wooden plug. In addition the earth can be loosened in pround the post with a bar and the solution poured down the side of the post.

(7) A good white ant solution may be made as follows

Mix s 1b commercial area e with x 1b commer sal caustic sods both in the dry c add no 1Use a suck for reasing. When there oughly mixed add water and stir up into a paste. A good deal of heat will be evolved when the water is added. Keep on adding more water and sturring until the total added amounts to a gallons. Then boil for a few manufes stirring metambile. When dool strain through deals have not or other qualities mixed to remove debras and bottle and to refe for use. Label White Am.

Street a White Ant Cure is also efficient and does not stain pine wood

For coating posts or other woodwork before putting into the ground the above described solution may be used with good results in keeping off white ants and prevent 1 grotting. Flymel will also serve well for the journous as will crude create or the

patent preparation Solignum

Be on "—Borer lestles are lable to attach furniture and woodwork. The presence may be detected by fine wood durit, and bores of the suce of a pun hole of larger. They are capable of do ng senous damage to floorer walls or furniture and require careful atten ton. They will statch hardwood as well as pen. Treatment of the surfaces with the whate art solution will generally dispose of them. It requires care in application be ng inhibit to damage certain kind of surfaces. A good wetting with turniture in applied to a lable to damage certain kind of surfaces. A good wetting with turniture in applied to always certain results. Carbon boulphade p nied on a selfective. It is informable in the presence of a sight and smalls offens why before a three.

Inte ted article of smaller furoithre may be cyanid d Famting infe ted surfaces will kill any be ers in the wood and wilf assist in preventing fresh attacks. During

inspection of buildings and furniture borer beetles should always be lo ked for

Co fL: gCourte x—Of this Ballour says. The motio where informance is blis in tolly to be says in an applicable to domestic a bygene in the tropics, and especially to the kitchens their americs and the servants latt e. Whe engular import consists curred out in this shows harm if it is pays to be clearly but it requires a great consists curred or district to keep them up to the mark. Statles usually requires good deal of holding after esp. By as e go the her presence of θ yan userus in them.

A Condit ing

Art § 1 cool as of the are in trop cal dwellings and a railway trains has long been practised. It use is had has been well described by Megaw (1991). The method commonly employed the edepends spon rapid ev poration of water from a "Khu Khus screen and upon draw age out rar through the screen and not the room to be cooled by means of a suction fan "Thus a constant supply of cooled art obtained file method is effecti. will when the atmosphere houndity is low. If possible the screen and notification of the sade of the form the supplemental of the screen and the screen and the room as the street of the form of the screen and the cooled by the screen and those fitting syning doors Cooling of the art may also be premoted by poryang the flow with satter or by hanging up shetts and keeping them well.

	Number of obser	Tempe degrees	Excess above		
	vatsons	С	F	whitewash deg F	
Black standard		66 2	151 2	36 3	
Black paint (9)	8	66 8	152 2	35 2	
Brown paint (8) dark	8	63 2	145 8	29 9	
Green paint (4) dark	8	63 8	r46 8	30 9	
Gray paint (7)	8	ór o	141 8	25 9	
Cement wash (P W D)	14	61 5	142 7	26 8	
Khakı paint (6)	8	59 I	138 4	22 5	
Red paint (P W D)	r3	58 2	136 8	20 9	
Aluminum paint	22	58 r	136 6	20 7	
Dull red paint (P W D)	14	57 7	135 9	30 0	
Plain tin	22	57 2	135 0	19 I	
Scarlet paint (10)	8 8 8	56 <i>3</i>	¥33 3	27.4	
Straw paint (5)	8	54 2	129 6	13 7	
Cream paint (2)	8	53 O	127 4	11 3	
Cream enamel (1)		33 0	227 4	11 3	
White enamel (3)	7 1	50 2	722 4	6 5	
White enamel (P W D)	14	49 6	121 3	5 4	
White atandard		46 6	113 9		

As a practical test one half of the corrugated galvanued iron roof of a bargs was whate washed while the other half remnange in the usual condition presented the rather dull surface of weathered metal. Jo the sunshare of the middle hours of the day the full ference in the temperatures of the two halves of the roof was very triking. The plan metal became very hot while the whatenached part remnaned cool and could be handled with comfort. In moving about under the roof which was low the radant het alm the plan half was oppressive while beneath the whitenached part it was possible to remnan in comfort without a fair. He not of the openion that nor of painted white self-dicted is as our unpainted roof had with wood. The glare from the white roof however would necessarily has to be taken into consideration.

Objection has been raised against the color of cement on account of its effect upon the eyes. Cement is not a pure white and soon weathers to an even darker color Chamberlain is of the opinion that the only objection to concrete is the monotony of the color which causes a depressing effect. This could be easily overcome if the were embedded to a certaine extent in the extensor of bushings to give veniety and color. The pink blue and green tiles of the Spannards are restful to the eye and attractive but as they require frequent cleaning are an item in upkeep.

as they require frequent cleansing are an item in upkeep

Termites and Other Insects Destructive to Weed—Extreme care must be taken to
prevent white ants from infesting buildings

The Department of Health Common

wealth of Australia gives the following measures for their control

(1) Regular inspection underrocath buildings raised on stumps the examination of each stump cap and ant stop for the earthes tunnels which show the trick of white ants the examination of the alls of buildings which are creted on concrete foundations and close inspection inside. Boards in which which earth are not range pixel & hollow sound on tapping them with the knuckles. The gnawing of white ants in infested tumber can sometimes be beard especially on a still inglet from made a building.

(2) Examination of any pipes of uther uncapped communication between the ground and the building. Where a pipe is brought up alongside a wall the protected side

requires close attention

A daily protein make of 50 grams is probably close to the min mum requirement whereas lumbermen and athleties perhaps require 250 grams or nor ℓ Jones said (X1939 θ) 183). In pract ce the protein make for all adults should not fall below 1 gram of protein per kind of hody weight it should be derived from a variety of sources and at least a part of it should be of animal origin. During growth prepancy and laction the requirests according to Jones are appromisedly in solitons.

	Grams per Kilo
Age (Years)	(2 2 Pounds) Body Weight
r-3	3 5
3-5	3 0
5-12	3 5
12-15	3 5
15-17	3 0
17-21	1 5
21 and upward	0
Women	
(o-3 months	10
Pregnant 0-3 months	15
Magazina	1.0

Studies of the det of 1000 residents of New York hiving apparently in normal moderate circumstances showed that 60 pc cent of them were taking duets yielding only 4 grams or even less of protein dally. It seems highly probable that careful examination of the gind aduals might have rescaled a idence of mainury tion.

The healthy young adult in the United States as represented by the average student of medicine has seemingly hecome adjusted to a proton consumption not exceeding to gram daily. Chittenden advocated a low protein det but the observations of McCay C stellar in de theirs would seem to obtained that a grant proton make than that recommended by Chitten See as necessary for the maintenance of good health but the contract of the con

bind y but that many investigate is have found no ev dence of nephrit is to The E kinns who for the usuand of yes. have been kving on an almost exclusive most diet at he very high protein content seen to enjoy excellent health. According the protein and the protein content is seen to enjoy excellent health. According the three proteins are the protein and the protein the protein the him with stamm a suferpart for potection against scayry and nekets while the Lah ador Eskimo who has aban doned has primitive methods of each tence who meants cooked and whose dust includes the protein and the pro

Carholydrates are dissuited as monoacetandes of sarchandes and polyacetandes. The sight upgars require to degistent on at are absorbed directly into the blood stream. The estingle sugars (monoacetan dee) octors into do or a ref. med from more complex carbobydrates in the process of digastion is e glucose or of attrios fructions or levulose and galactose. Until concreted into these single sugars carbobydrates cann the cultural day the body. Thus, the dischands sucross (carro of text usugar) milities under the complex of the

many prepared dued and canned articles is very subject to both these maladies

Food stuffs to in me carbohydrates or starches and sugars are represented by the tubers such as positores and yours the sugars of the case be it furth and honey and glyogen a muscle. The sugars include grandy starch and honey consist almost centrely of calobyld; is and with the po nible exception of honey is a lacking mail of the vistum s. The e.c. is of thobly drate is site of in the liver and muscles as glyogen. Gluoce can be derived from the c siturets of protein A certain main man percentage of gl. one in the blood is undespressable for the maintenance of health. The above mentioned can be bydrates are the main source of healt and energy are me. 1718 APPENDEN

Modern mechanical methods of air conditioning can now be used for cooling from or divellings and for regulating himselfly as well. There is a tendency however to maintain the end for the cooling as even as the condition of the

With reference to information published by Naglou (1921). It seems probable that the difference in temperature between the cooled room and the outer as should not exceed at § F and that a difference of 10 F might be preferable. Naglou and that deflumntification of air without much cooling as expectally inflicated in tropical climates and that it may prove the best method also in banks and stores where customers speed only a few majorites at a time. Similarly moderate cooline of steepine mainters would

probably be advantageous where the nights are uncomfortably hot

General use of mechanical cooling and dehumidifying devices is hinted at pres at
by their cost. Further revearch is needed all 0 to determine how these devices can be

used to the best advantage in the tropics

FOOD CLEMENTS AND FOOD REQUIREMENTS

Food include proteins fats carbohydrates inneral salts and nater but to sustain the body in beath they must be associated with variants and housdo or integration lats. Of these proteins fats, and carbohydrates are naturents. They are interchange able within the body as sources of heat and energy but proteins alone furm in marcal for growth and repair. Proteins increa e metabolism more than do carbohydrates or

Protess — These are very complex substances composed of mirogen carbon coygen by drogen and sulphur. They are colloids in character except in some leguminous plant is here they are crystaline. Proteins are essential for the maintenance of summit like because of the armon scade which they contain. Many it not all of these amon acids are essential for the building up and repair of body tessue. Only a few of them can be synthese of in the animal organism. Proteins vary greatly in biological value according to the different amino acids that they contain and to the proportionale amounts of the more essential enes. Proteins differed in might give the striple essential armon and as foldally lacking as much place to the striple essential armon and as foldally lacking as much place to the striple essential armon and as foldally lacking as much place to the striple essential the summation of the striple essential armon and as foldally lacking as much place to the striple essential them utilization in the body sites complete than that of protects of hugher biological value. The greater the aminanty of protein supplied to the tessues the lugher is its value beauce the biological protein value of must and find its three to four times as great as that of maste

In general the proteins of animal foods have a higher mitriture value than those expectable oring. The proteins of meat mill, and eggs and those cortained in figured has treases such as her kidney and swetchiesed have an expectally high notitive value for dail natural foods milk not only comes the nearest to being a balanced food children particularly but it contains in readily a salable form it grant of first than protein to the print (4 g 3 ft e 7 in addition to maintends vitamins catioblydrates and

fats (Jones 1939 p 1 9)

The anne author (Jones 10, 9) has emphasized the fact that the proteins of various legions including certain of the common kind of bean have a few nutritive shockes they are comparatively indigestable and because they are deficient in cysteme The contarty is true of the top bean after it has been heated In many cases the digestibility of proteins is increased by cooking but some of the amino acids may be det trood by error, ure to a temperature much above that of bonding water

Product requirements as they have been estimated vary enormously. These estimates do not ordinarily take into arround digestibility or quality with reference to content of essential amno and. Inoten requirements depend largely upon circum states. Severe labor growth pregnancy and lactation call for relatively large amounts

of protein

the supporting framework of body are included in the formation of many organic compounds and as every cell contains mineral e ements form an integral part of the cell structure. They also circulate in the body flinds in various combinations such as s organic salts as dissociated ions, and in more or les, loosely bound organic combina tions. In this way the moneral salt of the plasma serve to maintain the asmotic tension nece sars to bie and are determining factors in rentrality regulation. Even cosely related elements such as sod um and pota soum ex et their individual influence some are anta-onistic toward others and ome are synergists. It has been shown that the ingestion of large quantities of potassium as in a vegetable diet causes depletion of th sod um re erve of the body and the resulting urgent need for the e .. odium in the form of common salt as is ear ensured by hertivors. A more beneficial effect is exerted by calcium. In addition to the synergistic influence which this element exhibits toward iron Meltzer and Au r believe that a is abl to exceed morganic imbalance in either d rection that it nullifes the deleterious influence of socham potassium or magnesium and thus is capable of re-establishing normal equilibri in

The animal organism i capable of utrising morganic compounds of sodium potas sum calcium magne ium chlorine todine phosphorus a id iron when no other sources of these elements are provided. The various foods which are ordinaril found in the diet I ave a residue or ash when metabolized whi h may be acid forming or base Although the healthy animal is remarkably capable of praintaining the normal hydrogen too balance the normal diet probably should contain sufficient alkaline ask foods to balance the a id ask foods. Most people on investmeted diets form the babit of balancin-such a id forming food as meat eggs and white bread with base forming fru to and vegetabl a

Pequirements for most if not all of the morganic substances are greatly increased

during growth pregnan y and lactation

Carbonic phosphone and sulphune ands are cortinually being produced in metabohism. Under normal cord tions sugar siar has fats and portions of the proteins are burned to carbonic a id which is commisted by respiration as CO. Si of unc acid a strong mineral acid while reachly fixed by printerios is formed when the protein is resolved by hydrolysis into its constituent amino scids and must be disposed of even tually by neutral zation and excretion by the kidneys Fruits and ver tab rain general furnish be es caushie of effective neutralizate n. Hend roon has stated that neu rabite is a definite fundamental a d important characterists of th organi m. Foods in which acid forming elements pred mira e in rease the acid ty of the urine increase unnary ammoria and le sen the power of the unn to dissolve one acid which unt bet g de troved must be excreted as su h. As Cansum has stated foods that produce an acid usb result in a type of gradusts which produces sour taste sour perspiration scar unre and sout dispo it on

Calcium -- Lime constitutes about 20" of the body weight or a greater proportion t an any of the other morganic elements. Sherman (1939) stated that the ordinary mit d diet of Americans and Europeans hours in cite a and towns is probably muc often deficient in hime saits than any other chemical element. He concluded that food for an adult or for a child should furnish at least to gram I calcium ner day Cerman author two pla e the daily requirement for man as about a s grams a calcum onde or ; or gram of calcium according to I ush who quotes Tigersted a statement that the duet of Finns contains bein en a and 6 grams of calcium axide daily. The average adult therefore should take in his food daily not le s than a gram of calcium Cherman advand that mo e attention is aid be given to the tho ce of such foods

as will increase the calcium content of the dietary

The most practical means of insuring an abundance of calcium in the d ctary is to use m lk free'y as a food. As fresh mu k of good quality es rarely obtainable in the trops s this element must be supplied by canned or direct malk or other foods which are the principal sources of call um in uturzable form such as eggs spinach cauliflower peas beans string beans ca rots pursu ps turnip cabbag lettuce apples pine apples and the citrus f urts M Laughlin has compared the cal mm balance of a duet in which spins h supplied a e y had propo tion of the calcium with that of the same diet in which mi k formished an equal proport on of the element. The results were

easily absorbed than any other class of food and are essential for the proper combustion of fats

The carbohydrate cellulose forms the fibrous framework of vegetables. It is the chief constituent of wood stalks and leaves. It has title if any food value for man except that tender shoots and young leaves may perhaps be digested. Cellulose aids the digestion however by formong most of the residue which serves to stimulate the persistalist of the bowels.

The bemucelluloses agar agar and pectin are closely related to cellulose. They absorb water and promote acts on of the bowels by their bulk. On the other hand pectin

as contained in scraped raw apple has a beneficial action in diarrhoea

Fats—These are compounds of glyerno and fatty ands. Like carbohydrates they are composed of carbon hydrogen and orygen. They are represented by butter to fat of mest and a large number of vegetable mis obtained from nuits and seeds such as olive coora nuit and ectorostee olds. The fats serve as fuel and yield about twice as much energy in the form of heat and muscular work as an equal neight of carbohydrate or notion.

When an excess of fat is taken by sedentary persons part of it is stored in the body

where it yields no heat until oxidized

Lapoids of nitrogenous fats are indispensable though their exact use is unknown Sundardern said that a single experiment to which the died was ecceptionally rich in Junoids indicated that such as the was instrumental in raising the lipoid phosphoris level of the blood and that it suggested a method of treating the hypodiceithinsems which apparently is common in tropical residents notably in some and growing children. Experiences have been reported by tropical practitioners which emphasise the usefulness of letethin as a curative arent in case of debutive and tronical stakens.

Because of their relatively slow absorption fais increase the staving power of a meal. They also add flavor to food and some of them are important for their content of the fat soluble vitamos A D E and K. Lease (1930) and that there is hittle base for the claim sometimes made that hydrogenated fat is better in human nuturial stan anturul flats and that completeness of dispension is practically the same for all fatt having melting points below hody temperature

Energy Requirements

Food serves as the fuel which supplies the energy required by the activity of the organs and muscles of the body Heat is a by product Whatever the kind of food eaten approximately the same number of calones are required for the performance of a The number of calories obtainable by the human body from foot pound of work different kinds of food differs greatly Carbobydrates and fats can be completely utilized after digestion and absorption but a considerable energy bearing residue of protein is excreted chiefly in the unine and to a less extent in the facces On a mixed and ample diet there is some loss also of carbobydrates and fats. The physiological fuel values per gram for protein fat and carbohydrates are respectively 4 9 and 4 calories (Morey 1939) The caloric intake required for men and women in the United States differs in relation to height weight and occupation Sedentary workers require less than do those who are performing physical labor. Thus estimates for men range from 3000 to 4 700 calones p r day and those for women from 2 200 to 3 300 The requirement for a women may be increased to 3 500 during pregnancy or lactation The requirements for growing children per kilogram of body weight fall from about 100 calones in the first year to about 50 calones at the age of nineteen

Condiments —Among condiments are classed spaces collee and tea. They have no nutritive value except for the added sugar and cream but form an important adjunct to the dietary of both foreigners and natives in the tropics. By imparing flavor to many

tasteless articles of food they promote appetite and stimulate digestion

Inorganic Substances — Mineral salts are of the greatest importance in the formation of bone and assist in digestion and metabolism. While they are not or linarily classed as foods they are essential to life and include phosphorus sulphur potassium sodium calcium magnesium iron chlorine and iodine. They contribute primarily to

the supporting framework of body are included in the formation of many organic compounds and as every cell contains muncral elements form an integral part of the cell structure. They also icrediate in the body fluids in various combinations such as inorganic salts as dissociated one and in more or less slooely bound organic combinations. In this way the inneral salts of the plasma series to maintain the osmotic tension necessary to life and are determining factors in neutrality regulation. Even closely related elements such as sodium and potassium exert their individual indiscoces some are antagonistic to sard others and some are synergin. It I has been shown that the negation of large quantities of potassium as in a vegetable delt causes depthton of beroof common salts as no continued on the resulting ungent need for each of the order of the other and the resulting ungent need for each of the other of the other of the other of the other of the other of the other of the other of the other of the other of the other othe

The animal organism is capable of util nag morganic compounds of sodium potas sum calcium magnesium chloime isother photophorus and into a hiero no other sources of these elements are provided. The various foods which are ordinarily found in the det leave a readine or ask when metabolized which may be and forming or base forming. Although the healthy animal is remarkably capable of maintaining the normal hydrogen on balance the soomal dist probably should contain sufficient silkaline ask foods to halance the acid ash foods. Wost people on unrestricted diets from the shall of halanceng with acid forming foods as meat eggs and white bread with

hase forming fruits and vegetables

Requirements for most if not all of the morganic substances are greatly increased

during growth pregnancy and lactation
Carhoner, polaphoric and subjective and encontinually being produced in metabo
lam. Under normal conditions sugar starebes fats and portions of the proteins are
burned to exhome end which a deminated by respective. So Guiphuras end a
strong manufal and his result fatted by moveme and must be disposed of the
strong manufal send in the result of the proteins and must be disposed of even
tually by neutralization and exerction by the kindary. Finist and vegetables in general
furnah bases expublic of effecting neutralization. Henderson bas stated that neutrality
is a ded it if unid mental and unportate characterist of the originature. Foods in
which and forgung elements precionmants increase the ac day of the unner increase
tunnary ammon and lessen the poor of the unne to dussile sure and which not
being destroyed must he excreted as such. As Sassum has stated foods that produce
soor unner and sour dussor to soor unner and sour dussors to soor require and sour dussors to soor unner and sour dussors to soor unner and sour dussors to soor unner and sour dussors to soor unner and sour dussors to soor unner and sour dussors to soor unner and sour dussors to soor unner and sour dussors to soor unner and sour dussors to soor unner and sour dussors to soor unner and sour dussors to soor unner and sour dussors to soor unner and sour dussors to soor unner and sour dussors to soor unner and sour dussors to soor unner and sour dussors to soor unner and sour dussors to soor unner and sour dussors to soor the soor to soor unner and sour dussors to soor unner and sour dussors to soor the soor the soor to soor unner and sour dussors to soor the soor to soor the soor the soor to soor the soor the soor the soor the soor the soor the soor the soor the soor the soor that so soor the so

Cd1: m—Lane constitutes about s" of the body weight or a greater proportion than any of the other inorganic elements. Sherman (yay) stated that the ordinary maxed dut of Americans and Europeans living 1 cities and too a 15 probably more often defice rint into sails than any other chemical element. It is concluded that food for an adult or for a child abould furnish at teast 1 o grain of calcium per day. Cerman subsorties place the daily requirements for man as about 5 grains as a licium once authorities place the daily requirements for man as about 5 grains as a licium order det of Finns contains between and, of grains of a found marked by The account of the contains between and, of grains of a found order of claim in adult there if a bould take in his food daily not be than a grain of claim.

Sherman ad used that more attention should be given to the choice of such foods s will increase the calcium e ntent of the diet ry

The most pract c I mea s of insuring an bindance of calcium in the d say is to use mult [I yas is food % if 6 h milt of good on lar yn rarely obta rable in the tr pies th a clement must be supplied by canerd or dored milk or other foods which are the principal sources of c leuinn in utilizable form such as gregs pinanch cauliforms; peas beans string beans carrots parsin ps turnips c bloage lettuce applies p ne applies in the tortism I of its McLaughlah has compared the calcium balance of a det in which apsnach supplied a very high proportion of the c leuinn with that of the same date in which milk furnished in equal proportion of the clement. The results were favorable for spanish even when it furnished yet of the firms in the diet. A diet that is deficient in calcium is deficient in calcium is deficient in calcium is deficient. The distribution of importance for their ask content for vitamos and in the case of mile and mile and in the case of their proteins. Which calcium is lost it cooking when much only capture in the case of their proteins. Which calcium is lost it cooking when much only expectables are boiled but is retained with the water in the preparation of source current and stems. If it is generally considered that the monograme compounds of calcium as con

tained in diroking water are utilizable but Sherman has pointed out that unless a very hard water is used it is unlikely that the lime from this source will cover more than a small part of the calcium requirement. It is probable that the losses of food calcium is cooking may fully offset the calcium obtained from the drinking water. If is very easy to open a can but more difficult to prepare a good nutritious soup. Such soups may be thickened with gelatin and served cold. Gelatin which is an incomplete protein service within rather parrow limits as a aparer of body proteins and verified has shown that this power is greater when gelatin as taken with a mixed duet containing proteins. The short date that does not show that the such as the containing the same date of the date of the containing the containing the short date of the containing the containing the same date of the same that the same of gelatin by weight can be transformed by metabolism into elivore.

Phosphorus —The phosphorus chimanated in the unine added to that chiminated in the facces is largely a measure of the metabolism of nucleoproteins. Phosphorus compounds are essential to all tissues of the body and the growth of new tissue involves storage of phosphorus along with storage of amino acida in the form of protein

Sherman (1939) and that the average daily requirement as shown by 0, esperiments uses 08 By ram of phosphorus per po klogram (1935, pounds) of body weight. The difference between the requirements for the sexes were magnificant and the range of individual requirement was less than that for caforum fit beheved that a standard allowance of x 20 grams per day for an adult would be ample.

McCollum has stated must be sesentially lacking in fat soluble vitamin A. Jt.

McCollum has stated meat as essentially lacking in fat alouble vitamin A. It does however contain phosphorus and but lattle calcium and serves to change the ratio between these elements in the diet. This change in ratio be has shown is of great importance in the etiology of nekets and in the production of dental defects and disease.

VicCollum and others from experiments on rats found that the disturbances in the deposition of lime sails in cartillage and hone as the changes in the cells of those tissues which give rise to the pathological complex known as neckets may be produced appartuly in rats by disturbances in the det of the optimal ratio betacen calcium and phosiphorus in the absence of an amount of an organic aubstance contained in odd liver of sufficient to prevent them. The results of a large number of experiments seemed to indicate that in so far as calcium and phosphorus are concerned the physiological reliation in the died between the two so is affinishely greater importance in insuring normal calification than is the absolute amount of the saits themselves. In a later paper MCCollum Simmonds kinney and Green's reported the results of many exprending on rats which showed that a close relationship easits between vitamin D calcium phosphorus in the ratio of calcium make to phosphorus intake and took development.

Iron being an important constituent of hemoglobin is essential for human nutrition. The normal daily requirements for iron in the diet according to Dickson (1939) are approximately as follows:

	Milligrams
Infants r year of age	o 36
Children 5 to rr years	9 to 11
Men	rz to 15
Nomen of child bearing age	17 to 20
Older women	12 to 15

In general only about 60° of the iron ingested is absorbed. Digestive disorders fre quently interfere with the absorption of iron. The requirements of individuals may therefore be greatly in excess of the figures given above.

COMPOSITION OF ORDINARY FOOD MATERIALS (From Lusk after Atwater and Bryant)

		Edbi prt						
Kdff dmini p	1 4 61	W. t.	U I M n ton t	A dbf t t				
	phd			P t	Fi	C b	A h	F 1 1 p 1b = 453 6 g m lors
Ef('h) Rib R d l H d q rt B f(p d d	8 8 5 7	55 S	*	7 7 7 8	5 3 7 5 5		7 0 7	43 735 4
C d d R t coked		5 8 48	7.	5 5	75		5 0	75 4
V 1 (f h) H d q rt L	7	7 9 73	.,	97	70		0.8	74 4 0
Lmb(kd) Chpbild Lpt Pk(pildkd d	3 5	47 6 5 9	3	4 3	* \$		0 9	64 4
mkd) Hm Pk(kd)	3.6	4 3	3 6	5 8	36 9		3 6	9 5
Rib kd Pity dem (f h)		23 6	3.1	4	45 7		1	
Fwl Fb(fb) Cdtk	5 9	63 7	0.9	8 7	15.5		3	385
M k 1 Shilish (f h)	44 2	13 4	3	*	6 7		°	65
Ph(pdn		86 9	*	6		3 7	1 5	35
Cd mate b 1 Slm d	4 6	55 63 S	5 5 9	4 9	3 5		4 3	5 9 5
Egg buld Dany pod t t		73	Ì	١ :	4		0 6	755
Whinsh Skoom dimik Ches		97 9 5 34	3.4	3 3 5	13	5 5	5 5	31 7 1855
Btt Msc lla ou G I to		3.6	3	95 7	, ,		2 3	34
Celst Crn(m)m1 Otm1b1d Rub1d Gltnflo		54 S 7 S	9	7 5	0.5	13 5 3 23 8 7	0 5	6 s 8s 5 5 63

COMPOSITION OF OSDINARY FOOD MATESTALS -(Continued)

		Edible p rt							
	1 4 51			A 1 bl nutra t					
K doffoodmtnl	rfef pubsed matril	w t	U ava I bl t e I	F a	F t	Carb hydrate	۸'n	P 1 al p 1b = 453 c gram 1	
Wheat flor F mily a d st ight grad		12 6	۱.	8 5	١,	73 5		1613	
Bread					l		١.	1170	
Cor (johnnyc k) White whit		38 9	3 5	6 S	4;	45 8	?	1 95	
Sug stach te		""	1 **	١''	1				
S g r granul ted	i		1			10 0		1790	
estbls Asprgufh		94 0	0,	13	0 1	3 3	0 5	9:	
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Ajmo ds	45	4.8	0.9	7 8	49 4	15 6	1 5	1685	
Cocoa ts	49 0	4 5	9.3	4.5	45 S	25 5 0	1 5	255	
Pents _	50		10 7	31 9	34 7	, ,			

^{-} M

Among the best food sources of iron are jolk of egg and liver. Other good sources I clude fruits vegetables salads railms dates figs ants peas beans and lent is molasses cook and chocolate.

Copper deficiency is rare in man Like non copper is required for the formation of red cells and hemoglohin (Dickson 1939). The best sources of copper are the iron containing foods. A diet adequate for iron may be considered adequate for copper as well.

Isolar—Traces of the schement are found an most of the tissues the larger amount and concentration being in the thyroid gland in the thyroica molecule. While soldine is necessary to prevent thyroid disease extremely small amounts only are required free administration of small does not found in certain regions to prevent giving is well known. Yan Dijke has shown that tuched owner; a absorbed me readily thin nodate solding the contract of the c

Mogn's m Sod um and Potassium—These elements are seldom lacking in the det A sufficient supply of magnesium is furnished by meats and plant foods. An excessive intake of this element causes a calcium loss which accentuates at times the need for a liberal calcium intake. Potassium also is abundantly supplied by vegetables.

and fruits

Chlorus — Chlorue appear in the body mostly as chlorudes and largely as the sodium sail. The blood chlorudes in addition to other functions influence the vater content of the tissues through the maintenance of o motic pressure. Chlorudes are ordinarily taken in access of actual precis and are normally exercited in the unne in large amounts. The actual duly need for chlorudes in the form of the sod um sail is probably about a rama.

The comparative values of different foods as sources of vitamins have been dis tussed in the section on Detectory Diseases Much recent information on the vitamin content of foods on he found in Food and Life Ves book of the United States Department of Agneulture 1939 and in Human Nutrition Ves b ok Separate

No 1668 United States Department of Agriculture 1030

SANTTATION

An abundant supply of pure water is even a greater necessity in the tropics than in a temperate climate on account of the increased requirements for both 1 ternal and exter nal use but it is also much roore difficult to obtain. With the exception perhaps of that obtained from high unpopulated elevations and deep ground waters all water in the tropics must be regarded with suspicion until project to be safe. The habits of the nat ves in many tropical countries fav r constant gross pollut on of all visible collections of water which might be used as sources of supply | I ven unprotected wells are subject to f equent depos to of excreta. In some countries the problem is f. ther complicated by the religious customs of the patives. Pollution of an improperly guarded water supply may result in epidemics of serious d seases such as choleral dysentery typhoid and paratyphoid fevers The presence in water in some tropical countries of the s ail hosts of schistosomes may result in an infection with path ge ic cercariae. If such pollution occurs the water is dangerous not only for drinking but also for bathing purposes as the parasites are able to penet to the abroken skin. Water may be occasionally responsible for carrying other anim I parasites including amorbae and nematodes as the Gunea worm

Sources.—In general the sources of water are rain or snow upland surface water such as mountain streams ord any su face water as found no node lakes and streams ord raver water ground water obtar of from wells and apprays and lastly distilled water

() Rein Water—Pain as it falls is the purest water occurring in nature. It is usually stored in caterias of vio most & de ranging from a large cennent tank to the idnary e posed ra a b ref or tub. Rain water is very politable and because of the shae ce of salts of line and magnesia is very soft and satisfie for cooking wathing and bathing purposes. It is sa correstive action and readily attacks iron lead and rine. A clean imper—ous if face is de — the for all tackness at reash which in the tripose are 1726 APPENDEX

usually supplied by roofs The first portion of the water containing washings from the surface is rejected All cisterns should be water tight covered with an overflow direct to the outer air and protected against mosquitors by thorough screening of all openings including the intake and overflow mores.

(b) Highland Surface II after—This coosists of ratio water drained with comparative rapidity from the more rugged regions and contains a relatively small amount of inorganic matter although it may have more or less organic matter depending upon the nature of the surface drained. It manks next after ratio water in purity.

(c) Surface Water — This is obtained from small streams natural or artificial ponds take and lakes where it is subject to frequent and repeated pollution by both man and animals Surface water should never be used without orchiminary punification

(d) Riere II ofter—I has long been a popular belief hat running water if not always pure will purity ties! while flowing a dozen miles or so. In recent experiments regarding the eaygen demand of Ohio River water eaygen was consumed for fully soc days and bacteria, of intestinal origin presisted for almost that length of time. In the densely wooded sections of the tropics rivers afford the main if not the only method of communication consequently population groups tend to establish settlements in close prozimity to the larger streams. Sewage from these communities is either added inertily to the waters or washed into the streams by the torrential raise. Follution hazards are therefore greatest at the beginning of the raisey season and along the shorts raise than in the center of the larger rivers. While water from streams flowing through the state of the results

(e) Ground W airs —The water that is absorbed by the ground occupies the spaces between the particles composing the soil except in limestone formations and finally rests upon an impervious stratum. It is brought to the surface by wells or springs.

(f) If ells -A well which is essentially a hole in the ground may be either shallow deep or artesian A shallow well usually is one that is dug and varies to depth from a few to rarely over so feet. A deep well is one which extends to a depth of roo feet or more without passing through an impervious stratum. An artesian or flowing well is one which passes through an impervious stratum into a previous one in which the water rests upon a second impervious stratum Shallow wells are supplied by the ground water which filters into them from the soil above the upper impervious stratum Shallow wells may become polluted by drainage from soil that contains an excess of organic matter by water which enters without filtration through crevices channels or fissures such as exist in himestone formations or by drainage from nearby cess pools leaky drains or other gross source of pollution | Experiments conducted by Stiles and others have indicated that bacterial pollution occurred in wells located up to 232 feet and chemical pollution up to 450 feet from the source that both chemical and bacterial pollution traveled in the direction of ground water flow and did not appear to extend laterally that the colon bacillus teeds to localize in the upper blanket at or near the ground water table and water takeo from this blanket may show heavy Escherichia cols (B cols) pollution while water a few inches lower may be E cols free that F cols tends to filter out into the capillary fringe when the ground water falls or into the soil in case of still further fall and if the soil remains dry suff ciently long L coli does not survive Wet weather with high ground water is therefore conducive to the extension of pollu tion while dry weather with the resulting lowering of the ground water is inhibitive to the extension of pollution and favors purification of the ground water

Open aclls especially on the tropics are subject to surface pollution and should be looked upon with suspicion. Wells should lamps be closed at the top by an impervious locked upon with suspicion. Wells should lamps be closed at the top by an impervious cover preferably of concrete constructed with a slope from the center to the outer edge. This may be built in the form of a circular should, or a feet wide which should be rine gail with or make a tight joint with the casing. An impervious casing of concrete or brick laid in centeri mortar should extend at least its anches above the surface of the ground and into the well as far as practicable preferably to r foot below the lowest erround water level. Water should be removed by an ord nairy suction painty firstly

secured to the concrete cover and equipped with a flange to prevent dismage back into the well or when this is not practicable by means of compressed ar. The cassings of deep or artesian wells should be constructed with vatertight joints in much the same man er so that surface pollution will not be carried into the well. As well water keeps better in the dark protected from the outer air ventilation of wells is not necessary (i) Sp mgs are the surface outlets of ground water and may or may not be safe

depending upon the character of the ground water. The source should be protected by an impervious covered concrete hose and otherships by gravity through a pupe. Butles (1928) states that crystal clearners of spung water is not necessarily an index of its porbability. A sparking clear variety may be heavily infected and therephy dangerous to those who drink it. The results of bacteriological examination of many springs in Haus showed heavy contaminations with facetal bacteria. He also states that in some topical countries the calabash or gound like front of the calabash tree the larges spontines of who have a capacity as great as explicit liters in used by many patives to carry water. As used the calabash cannot be filled without contaminating the water by human hand. The calabash is a carried by natives by inserting a finger into the tilter opening thus contaminating the water a second time. Water cannot be sterlized bacteriological tests show that the other closer of these chemicals in absorbed or which can be desired to a calabash cannot be water as which can be detected on the contaminating the sterline of the contamination of absorbed or which can be detected on the contamination of absorbed or which can be detected on the contamination of the section of the sterline of the contamination of the section of the contamination and the section of the contamination and the contamination of the section of the contamination and the section of the contamination and the section of the contamination and the section of the contamination and the section of the contamination and the section of the contamination and the section of the contamination and the section of the contamination and the section of the contamination and the section of the contamination and the section of the contamination and the section of the contamination and the section of the contamination and the section of the contamination and the section of the contamination and the section of the contamination and the section of the contamination and the s

Water Requirements—A generous supply of sater is desirable but at the same time unnecessary water should be discouraged. The daily requirement per capita varies greatly and depends both upon the sanitary arrangements and the hishes of the individual. It is stated that the average amount per person per day for domestic purposes is about 17 gallons. Of this 3 pains are used for dinaling 3 paints for ecolomic 5 gail loss for tabing 6 for waining and 5 for sanitary purposes. (There punts of ordinaling should be regarded in the tropics as a minimum). Figures for some European towns which have a metered supply show a daily per capita consumption awaying from 5 which have a functive display show a daily per supplic accommission awaying from 50 min. The same shows that the same shows

250 who if Lichtut it is a stated that 40 to 50 failons per person mixt be supposed daily Dual Water Supplies — A double supply of water one of doubtful purity for general purposes and one of unquestioned purity for personal use is mentioned only to be conversely to the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the century of the control of t

less so far as infections are concerned

Water Purification.—In general the methods of purification are natural physical mecha itsal and chemical

- 1 Act al Mitheds Acture a methods of purifying water include the sell purification of streams storage and sunlight. In the tropics the prohability of f equent contamination from native sources renders natural methods so unsafe that no dependence should be placed upon them.
- 2 Phys. I. Melwid.——Stethods which include bot | g and distillation it do it the watch that and unpulsiable though its can be a critian settint be overcome through crit in by stak g vigrous ly in a partially fill dc. tainer. If left sproads to the air corregits with due precautions agar at containmaint on suffice it am wild be taken up to remedy this defect. Bo long has the advant ge of kill | g airmail as well as vegetable its and moreover bouled water is ready by obtainable an countries where tead domining is habitual. If placed in clean bottles in the evening a dist openings p of cetted by pd goof cotton one over which gainer the via term all be cool and palatable by the follow i g m rang. It is describle with next velong in the trope is centry a supply of boiled water from o e camp in order to assure a suply log pure water topon are all at the next.

3 M hanted V thods - Sed mentation and filtrat on are the usual mechanical means f purifying water and are generally comb ed with chemical methods. The

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domestic filter as ordinarily used in the household has a very limited santary value Of the filter candles Ballour recommends only the Pasteur Chamberland and the Doulton Domestic filters need to be stenlined by boiling revery third day as otherwise betters appear in large numbers in the filtrate They must never be left to the care of native servants

Filtration of public water supplies is accomplished usually by means of sand filter beds either in the form of slow sand filters or in smaller units or tanks, the so-called

mechanical or tapid sand filters

(a) Slow Sand l'Altration — These filters consist of large shallow tight underdening reservoir continuing statisfied filtering material of progressive digners of finense into morboken stone or gravel at the bottom to an upper layer of fine sand. They require an extensive tract of land and whole the original cost is large the mantenance out comparatively small. Sedimentation is necessary to prevent rapid clogging of the liters. It the water contains much fine site prehimmary chemical congolution much required. The water passes slowly through the sand and is collected in draws placed under the filter s.

The process is mainly a biological relation and partly a mechanical straining. The bacteria algae and other microorganisms form a glatinous growth coating each grain of sand in the surface layers. This growth constitutes the schmid decke which effectively holds back the bacteria in the water. The action is uniform removing about of

of the bacteria and one third of the coloring matter

(b) Mechanical Filters - Mechanical filtration requires the addition of a chemical coagulant usually the sulphate of aluminium alum or iron to the water Calcium carbonate is necessary to produce roagulation and if not present in sufficient quantity lime saits mu t be added. The amount of the coagulant must vary in accordance with the turbidity the reaction and the amount of calcium in the water. After pas ing through sedimentation reservoirs or tanks where a large amount of the coagulated matter and bacteria are deposited the water is passed rapidly through the sand filters where the straining process removes the auspended particles remaining in the water The filters are cleaned frequently by reversing the flo v These filters occupy a small area of ground but have a capacity per acre per day from 100 to 200 times that of the slow sand filters The first cost is comparatively small but the maintenance cost is large They are especially suitable for turbid waters containing silt and clay removing nearly all of the dissolved coloring matter and from q, to 00° of bacteria Despite the approximately perfect removal of disease causing microorganisms by sedimentation coagulation and filtration under actual working conditions breaks may occur in the process of filtration Therefore there should be equipm at for final chemical distance Many cities chlorinate the water as it leaves the filtration plant tion of all supplies

4 Chemical Steril attern—An ideal chemical agent for the stenlarston of water must be increasive stable in composition rapid in action and non poisonous without producing a disagreeable taste door or color. Better results will be obtained in the water is first claim fed by coagulation sedimentation attraining or filtering. A number of substances have been tultized for this purpose among which may be mentioned potassium permanganite sodium hissiphate udone and chlorine. The latter used in the form of (o) Gas from cylinders applied directly to the water in purpos at inclosed chambers (dry feed) or by first dissolving in a small amount of nater (wet feed). Chlorinated lime (c) Interaction at chemicals. (d) Organic Cloime compound)

Chlorinated time (c) Interaction in entitled (a) Organic tribute composition Potassium pern anganate is rively used as the action is feeble and uncertain and the color objectionable. It is of value in the removal in disagreeable odors by oxidation and

is said to be particularly efficacions in the destruction of cholera vibrios

Sodium bisulphate in tablets in effective in a dose of 1 sgrains to one part of water. The purifying action depends upon the liberation of free sulphure and. This compound deteriorates apidly and/all a dower an extended period of time of in any quantity is prone to have a decided lixative effect. Ballour states that the bisulphate forms soluble sulphates with certain time metals. If can be safely used in altiminum water bottles but not those made from alloys containing copper. In time containers it forms a tilt. Evoraw sulphate which redefirs the water undornkable

Iddine Hitchens (1922) emphasized the use of tincture of indine in the dosage of one drop to a cantenful or approximately one drop to a liter to render water potable.

Chloring is a potent germicide and the most useful of the halogens as chlorides do not have the depressing action of sodides or bromides Chlorine gas is formed by the electrolyt c decomposition of salt solutions The most gas is dried and then compressed into a liquid in steel cylinders of about 100 pounds capacity. The method of disinfec tion by chloring gas is extensively used in the United States but in replated communities cylinders are difficult to procure and other methods are usually found to be more readily and cable. Chlorinated lime made by saturating slaked time with chloring at ordinary temperatures is an excellent source of chlorine but has the disadvantage of being very unstable The hypochlorites upon exposure to air deteriorate rapidly to the more stable and mert carbonates. It is therefore necessary that the substance be kept in air tight containers and protected from bight. The amount of hypochlorites is usually expressed as available chloring which is the chloring readily liberated from its combination as determined by the usual titration with sodium thiosulphate. The available chloring in a fresh sample may be as much as 30 or even 35" but frequently a sample will show less than 200 Some samples kept under ordinary storage conditions have shown less than to

Chlorinated lime is soluble in about twenty times its weight of water leaving an insoluble residue consisting mostly of calcium hydroxide. If if a pound of chlorinated lime dissolved in one gallon of water makes a solution containing approximately 600 by weight of ehlorinated hime representing about 2" f available chloring. A clear solut on of chlorinated lime may be readily obtained if the undissolved fraction he allowed to settle Sedimentation of the insoluble portion may be as isted if precautions are taken to mix a sufferently thin paste others use a gelating ng action take place and greater diffi ulty in settling is encountered. One pound of chlorinated lime should oever be mixed with less than one half a gallon of water. A stock solution for the chlorination of water in the feld may be easily prepared by adding one half teaspoonful of chlornated lime to a point of water. This solution should he f eahly made from a good grade of chlorinated hime having a st ong odor of chlorine Specimens of chlor mated lime that are moist caked or fumpy are generally low in chloring and therefore should not be used. Of this stock sofution use one to spoonful to a gallon of water o 15 drops (about 1/4 teaspoonful) to one quart and fet stand at least 15 minutes gives a free chlorine strength of approximately 3 parts per million which is considered sufficient for ordinary clear water. In the absence of a solution to test for free ebloring or if there is doubt as to the strength of the hypochlorite, the usual field method is to add the hypochlorite solution until the water gives a slight taste or odor of hloring

Raw waters differ greatly with me pect to the amount of contained organic matter and therefore vary in their capacity to form compounds of chlorine that have no disalectant action. Some naters will require more chlorinated function that other than others to insure the presence of free chlorine aft r. 5 minutes contact. Reflat vely pure waters chlorinated to the extent of o.5 to 1 part chlorine per million as a rule contain. 5 minutes later toom one fifth to one fourth of the amount added. If it is impossible to test for residual of the many time of the contains a substitute that the many in the office of the contains the contains a substitute of the contains the contains a stable evidence regrading owner vegetation and pollution has made in the contains the cont

The Lyster bug des gued by Colond W. J. Lyster U. ried States Army may be found effective for tropical use. It has been found by the either to be practicable an most valuable during a number of tropical countries. It holds go gallons and consists of a cavays bug seen to a palan red in night process of the contribution of the

(a) Set up bag adjust the cover and strain in the water to within about a inches of the ton

(b) Obtain a clean stick or anme other device for stirring the water. Place the stick

in the water and let it stay do not take it mut of the water

(c) Place 1 gram of chlorinated lime in a canteen cup stir the bowder with water making a paste first and then pdd enough water to dissolve all of the soluble powder Pour the contents of the cup men the bag. He sure the chlorinated lime used has not It hould be dry and give off a pronounced odor of chlorine. If available and in good condition brown class tubes made for the purpose each containing I gram of calcium hypochlorite may be used gram in gram instead of chlorinated lime from some other supply. As used calcium byrochlorite on the labels means chlorinated lime

(d) After adding the chlorine stir the water in the hag thoroughly and allow the water to stand 15 or preferably an minutes before upone. At the end of the 15 or to minutes contact period add sodium hyposulphite if available in the proportion of a gram to a grams of chlorinated hime. Again stir the water thomughly and wait a few minutes before using

(e) If an orthotolidin testing solution is available it may be used to test for the pre ence of free residual chlorine in the water after a se minute contact period. The dosage of chlonnated hme (calcium hypochlonie) may then he regulated so that only enough is added to satisfy the affinity of organic matter present and leave a small amount of free chlorine (residual chlorine) at the end of it minutes contact-o 2 parts per million or less

(f) Sodium thiosulphate (hyposulphate) combines with free chloring and removes the odor and taste resulting from the presence of the latter. A tube containing a gram of sodium thiosulphate made for the purpose is broken into a canteen cup filled with water the crystals are shaken into the water which is then stirred with a spoon and allowed to stand for 30 minutes. The solution is poured into the Lyster bag and the contents are again thoroughly stirred with the stick which has been left in the hag In make certain that the faucets have been flushed with the excessively chlorinated water 5 cupfuls should have been run through each faucet and poured back into the hag five to ten minutes before adding the solution of sodium thiosulphate. The

water is now ready for drinking (e) If scales are not available a gram of chlorinated time if dry may be quite accurately measured with an empty Colt 45 calber cartridge shell which holds about 1 gram if filled level by pouring in without packing down in any manner except by lightly

tapping the shell once or twice The effect of halazone which is p sulfone dichloranudobenzoic acid depends upon the liberation of free chlorine for its germicidal action. This compound can be pur chased in tablet form (p 1703) When protected from moisture it is remarkably stable even under tropical conditions

Schage Disposal

Sewage may be defined as solid and liquid excreta combined with other solid and liquid wastes from houses and other buildings diluted with the water used. The basic principle according to Whipple is the disposal of sewage as soon as possible with the ast nuisance to the smallest number with the least damage to health or property and at the lowest cost Improj er disposal may have a direct effect upon health by transmis sion of disease or may create nuisances both objectionable and offensive The simplest method is found in cities provided with water and sewer systems where the sewage is discharged it to large bodies of water and disposed of by dilution with subsequent natural punification. In most tropical locations where this method is not feasible recourse must be had to other methods

The privy is the simplest method for the disposal of human excreta They are gener ally classed as ground pail earthput deep post hole concrete vault chemical and sentic privies In all types the access of files to excrete should be prevented through tight construction and by keeping the seat covers closed. This may be accomplished by small blocks placed at the back of the seats which will automatically cause them to fall shut when not in use.

The Pail Prity—In some small communities provided with a satisfactory scavenger service this type may be used with nucress. The pail privile but on top of the ground and is constructed with a tight fitting hinged cover at the rear with pails placed under the seats. When the pails are about three fourths fell they are removed by the colleger covered for transportance and the contents disposed of by hursal in shallow

trenches away from sources of water supply The pails are then cleaned and disinfected The Lumsden Roberts and bules Privy - This is a simple and inexpensive appara tus for use in the safe disposal of night soil and operates upon the principle of the septic tank It consists of a water t ght tank barrel or other container to receive and liquefy the excreta A covered water tight can or other vessel to receive the effluent A con pecting p pe about 234 inches m d ameter and about 12 inches long the end in the receiv ing chamber is provided with an open T both openings of which are co ered with will A tight box preferably sinc lined which fits t ghtly on the top of the lique screens fying barrel. It is provided with an opening on top for the scat which has an auto matically closing hd. An antisplashing device consisting of a small board placed horizontally under the seat about n inch below the level of the transverse connecting pine It is held in place by a rod which passes through an opening in the side of the seat and by which the board is raised and I wered A layer of thips floated in the ta k may be used in place of this device. A ventilating p pe connects the space under the seat with the open air

The hquelying tank is filled ath water up to the point where it begins to trickle into the effluent tank a pound on to of old manue a should be added to the water to start fermentation. A film of some form of petroleum should be poured on the surface of

the hq id in each co tuiner as an insect repellent

When the pri y is to be us d the rod is pulled up so that the antasphating board must to within about an inch of the su face. As the fee call material falls into the write the board pre cuts splatning. Although some of the exceta floatiant is protected from fine by that sutomatically closure filed by the water by the film of oil and listly by have ing the apparatus in a thoroughly screen d out but fil g which should be done for add though safety. The film of oil prevents mosquate beeding in the tast.

The faceal mate 1 ferments 1 the water and gradually liquefies. The level of the liquid is raised and the e c as flows into the effluent tank where it is protected from insects by the er and by a film of oil. This effluent may be allowed to collect until treiches the level of the co. I is grope, when it may safely be disposed of by disinfer.

tion and bun 1

The Sephe Tank.—The purpose of a sephet tank is to d gest and bugsty a large per centage of the suspended solads but doe not necessary purply the see ge I may be post ble in some instances to secure dibtus sufficient to omit treatment of the sephe tank effluent by discharging the overfloot most sterams with a large flow at all times. The effluent from a sephe tank may contain large numbers of harmful hacteria and US Marine Copie larged its post tank may contain large numbers of harmful hacteria and examiliar mount of fresh hone manuer. Define the manufacture of the manufacture

The design of septic tanks should allow for sufficient capacity. Capacity refe is to the amount of liquid that may be retain. If a low the bottom of the outlet pipe a d not the tot I volume. Friesdences the haud capacity varies from 335 gallons frigorisons to 1500 g llons for 30 persons. I lets a doubt its should be arranged so as a constituting up the context is a distinct would interfer with sedimentation in the order to the state of the sta

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increase the probability of clogging. Access by manholes or by removal tops must be

provided for cleaning purposes

The effluent from septic tanks is usually disposed of by soil absorption from cess pools or by seepage from underground purous tile drains Sewage disposal units must be located so that see; age cannot reach any water supply under varying conditions of soil or underlying rock and ground water. In general they should be located as far away as practicable and never on a direct alope toward well springs or other water supplies. It should be borne in mind however that water supplies may become polluted through variations in the level of the ground water or through neculiar under lying geologic formations even though sewage disposal units are located at lower surface levels

NOTICES ARTHROPODA

Flies - Many diseases expenially those transmissible by discharges from the intes tinal tract are spread by means of food fineers and flies with human facces at the source of the infective material Howard (1926) states that collections of flies from dining rooms in different parts of the United States indicated that the true bouse fly comprised the greatest number. Other species observed were the bitiog stable fly and the cluster fly Several species of metallic greenish or bluish flies were also found occasionally These include a blue bottle fly the black blow flies and the green bottle flies which breed in decaying animal matter

Carriers of Disease -The true house fly which is found in nearly all parts of the s orld prefers to denout its eggs in horse manure. It will also feed on and breed in human excrement and because of this habit is dangerous to the health of human bings The fly may carry on its body the causative agent of intestinal diseases such as typhoid fever dysentery and cholera from the excreta to food supplies or deposit various microorganisms in its excrets. Wenyon has shown that the E histolytica ingested in the cocysted form may be passed in the facces as to so hours later. In the case of over so different disease microorganisms and parasitic norms actual laboratory proof of traosmission exists and where tacking is replaced by circumstantial evidence amount ing simost to certainty The house fly has been found to breed freely in hog roanure and to some extent in cow manuse. In fact at will when necessary lay its eggs on a grest variety of decaying segetable and animal material. Dunn has stated that in I snama a fly may deposit as many as 2367 eggs in 21 groups and sometimes an interval of only 36 hours may occur between the deposition of large numbers of eggs

Power of Emergence from the Soil -A few hours before pupation the larvae migrate from their feeding ground in search of a lavorable place in which to pass the pupa stage They may crawl considerable distances from the I lace of their origin to pupate in the ground or in other loo e material The adult fly upon emerging from the puparium works its way upward to the surface. Wallace states that the newly ratched fly is able to ac omplish this through the inflation and deflation of a frontal sac attached to the head between the eyes Experiments showed that house flies on emerging from the pupae were able to penetrate a covering of 6 to 7 inches of garden soil and a double layer of 2 mm mesh mosquito netting Passage through the netting was made by inserting the sac within the mesh and then inflating. With expanding of the wings in final development after exposure to air the capacity for inflating the frontal sac is lost

Fly Papers and Poisons - The use of sticks fly papers in the destruction of flies is well known and fly poison preparations are common. A very effective fly poison is mad by adding a teaspoonfuls of commercial formain to a pint of milk or water sweet ened with brown sugar A convenient way of exposing this poison is by partly fling an ordinary drinking glass with the solution A saucer or plate is then lined with white blotting paper cut the size of the d sh and placed hottom up over the glass The whole then quickly inverted and a small match stick placed under the edge of the glass As the solution evaporates from the paper more flows out from the glass and automati cally renews the supply

Fly traps may be used to advantage in decreasing the number of flies not only for immediate results but because of the chance that they may be disposed of prior to ove

deposit. Experiments with marked their showed that the house fly may travel as far as 11 miles in 40 y days. Some flues were caught as f r as 17 miles from the point of liberation. The length of light indicates the necess 19 for using traps as well as control of local breeding places. An effective interposes a and serviceable trap may be made with four wooden barrel hoops one barrel head four laths together with the necessary ware mesh screening. The trap consists essent illy of a screen cylinder with a farmer made of the harrel hoops and lath in the bottom of which is inserted a screen come. The height of the cylinder is 23 makes the daareter 18 inches and the come 25 miches in height and 18 inches a diameter at the hase. The effectiveness of the traps will depend upon the election of basis. A good basis for house fleas is part of molasses to 3 pasts of water after the mixture base fermenting harmes give good results blue as a mixture of equal parts of brown nager.

a de end of sost milk thoroughly m give of after it has stood for three or four day's Prece time of Pp. Bered at p. —The most logical method of absting the fixy numane is the chimnation or treatment of all h evels galaxes. The destruction of adult files is set best only a temporary exped end it; a sit substituted that all manure be placed when practicable and as soon as possible after its soded in dividing that of the processor privarily of concerned. The essential point is that fine be prevented from meaning the minute before it is placed in the container. This frequently happens and 6 is emerge before the container is empired. To obviate the est ape of a 1 v) hatched files opening large enough to attract 6 is to the high may be made in the cover and the opening overed with of any contact large are get so the bottoms of the trues will file closely.

to the cover

Clement Treatme: I Manner—With the object of finding some cheep chemical sharkwould be effect; or neterroung this have at those of rolling the feeth in white the Bureau of Entomology conducted a erics of experiments with a number of chemicals of the substances tried powder do helploor gave eventilent res its. A stery extract p paper dby adding one half p und fithe p wder to regallons of water and allowed to stand as abouts as then sprankled over the manure in the proportion of or gallons to every rocus (if. This treatment results in the destruction I \$8 to open of the lar ase littles for every nonewhard p pomous to hive st. 6.

Another chemical even mor feet cas a lar vide is pondered borns. The min, must amount necessar to kill fly larvar was found to b one pound to is cubic feet in this proportion gorg of the lar as vere destroyed and h ver applicat one killed from glt to gorg. Best results on bits in d whe the borar was applied in solution or when water was sprinkled after the boa had be nexatt red evenly over the manure Applied in the liter man or one half pound of exclusions a my did not paid pround the statement and one half pound of exclusions a my did not not half pound of exclusions.

acid phosphate pe hushel of m nu g e a apparent farvic dal action of 93°.

Trap for the Deil 1 of Fly Larrae — This m the dish sed on the fact that larvae of the larvae of the larvae.

of the house fly show a strong tendency t sugrate a few how a before pupation. The manures ap led upon a slatted platter in his attuals about 1 foot above a concrete floor. A rum of concrete 4; thes high and rutegral is 8; for unds the floor which is 8 per detoward once erner. It rum has o er a pupe fleed for a small flostern nearby. The pupe is stoppered and the concrete floor filled with the to a depth of on inch in the shaflowest part. When hi 1 mg te they drop into the wite rare drowned the shaflowest part. When hi 1 mg te they drop into the wite rare drowned conclusions of find were and more than the externer. The platt me beneath must be kept fee of conclusions of man ure and monitous pole in gratiants to the plate of the tech brace of the conclusions of man ure and monitous pole in gratiants to the plate of the tech brace of the conclusions of man ure and monitous pole in gratiants to the plate of the tech brace of the conclusions of man ure and monitous pole in gratiants to the plate of the tech brace of the conclusions of man ure and monitous pole in gratiants to the plate of the tech brace of the conclusions of man ure and monitous pole in gratiants to the plate of the tech brace of the conclusions of the tech brace of the conclusions of the tech plane and the conclusions of the tech brace of the conclusions of the tech brace of the conclusions of the tech brace of the conclusions of the tech brace of the conclusions of the tech brace of the conclusions of the conclusions of the conclusions of the tech brace of the conclusions of the c

C m p of $Hasp _{L^{\infty}}$ bother method ecomomended by Emplish writers consists in building the manuer in a compact rectangular heap the a des of which are beaten had such shorels. Loo extra v in h a d a such the pile about foot from the edge. The exclusion of air v to the v with the h the pire repeated and v are formed by I mentation of air v to the v with v the had the pile v to v the v

tion with this method to attempt concurrent destruction of the adult files. Accordingly of drums were turned on end and a solution of te^{**} of sodium assentie in water contain ing 12^{**} glycerine and 5^{*}₀ sugar was poured in the saucer like depression in the top. The files collected in masses and were killed in enormous numbers.

While har e manure produces the greatest number of fires breeding in other material should also be prevented. Carbaye and other organi matter must be placed in fly tight containers until collected and all decaying vectable and animal matter must be

properly disposed of by incineration or burying

Apray —An efficient insecticed for files in kreache musts tack belongs some species of anis, and many other insects may be easily prepared by maring pyrethems flowers with kerosene turpersher substitute or other similar by discussions may also proportion of a pound of pre-kerom the produced or composition for some may also be used to a gallon of the oil. The merture is altioned to stand two to three day and then percelated once. One percelations removes about 95% of the active punched then percelated once. One percelations removes about 95% of the active punched then percelated once. One percelation removes about 95% of the active punched death within a few munits. In the case of conformation the debugs which are currently in their habits it may be applied so the evening feely to the places frequented by them.

Flit and various similar proprietary enrace are very effective again t flics and

other insects but their use is limited by expense

Mosquitoes — Vessures for the control and destruction of mosquitoes involve the elimination of breeding places by filling drange both surface and sub-urface introduction of sex water into access of fresh water tirmining and cleaning of banks of streams and lakes cutting of brighs and grass together with the climination or streams of allows of the most of the control of services and the surface of the surface

empty hottles

When drainage filling and the use of fish are not practicable various larvordal agenta may be employed. The most common of these are petroleum both crude and refined old crank case oil diluted vith 5 parts of kerosene and t of castor oil crude and refined old crank case oil diluted vith 5 parts of kerosene and t of castor oil crude phonol creas? Paris green and the so-called Parisam larvorde. The latter which was successfully used by Mason is compounded as follow a Add soo pounds po deed ream of 150 patients over the phonol. He far intuitive to art? I want uniform haped is obstanted Disolve 50 pounds counts cased an 6 gallons of water and add to mixture stimmed Disolve 50 pounds to the minute simple memoriality employees with water. The larviseds may at 150 peop combission in 30 minutes. Sprankled upon the water in a 10 reconstitution of the minute in a 1 to 10 peop solution it spreads rapidly through they after and will sall lives oils a the soapy characteri the satesfers with satisfactory filmin. Edicary is impaired by exposure four. Costs as (so ocents per gallon)

by exposure to an TOSES 3-160 Series per gamon Falber and Hayne found Paris green effective in destroying anoth line larvae The application of insecti idal dusts by aeroplane was first demonstrated by the Army Art Servi e in cooperation with the Ohio State Typerimental Statron in August 1921 and excellent results have been obtained in the United States in the distribution of Paris

gr en by this method

Experiments conducted at Quantine Man 1996 showed the effective quantity of Paris green to be one pound per acre. Flying at an altitude of 1906 test of 180 at 32; metric with powdered soap stone or hydrate line was effect. e. In winds of great, reviceding and at altitudes greater fine too foet as 90 metric was required. Material coats about 70 certs per acre per jeason. Read dost sand sales flour satisfact other material. have been neutroned as satisfactory discussion, read dust stand at area of the sales of the sales of the sales of the sales of the sales and the sales by a hand matchine such as the Chrimpson dasters. Griffitis found that a matture of wet sand and Paris preen is sopportably behalf to sob surface as well as surface feed if mosquite larvier. Local confittions however determine the pathods which will give the best rule that each locality. The two of I are green dust muture was found to be the best rule that each locality. The two of I are green dust muture was found to be of little value in Panama not only on account of the difficulty in keeping the mixture dry during the long ramy season but because most of the powder would adhere to the most surfaces of the vegetation and little of it would reach the surface of the water

Many species of anopheles after becoming engoged with blood are so encumbered that they ordinarily do not by for a considerable period of time but rest in suitable shaded places near the locat on where the blood meal was obtained. Daring has shown that about two and one half days elapse after feeding before the blood meal is expelled Recently on orged anopheles at rest are related by easy to destroy. They may be collected on a layer of cotton in a be the containing becomes or child ofform or in a Guffitt scatching tube. The od nary fly a atter or the pyrethrum krossene spray noted abo c in the control of flew snay be used to day antage. The former method however preserves the mosquito w thout must lat on for the purpose of identification. Through streaming of buildings in maknows distorts and segregation of foreigners far apart from native villages are important preventive measures. Repellants are poor substitutes for secroging. Opens as crueful in onche of spaces. See also p right.

The Bedhug -This insect which is nocturnal in its habits has been recognized since the bog n ing of recorded history and as a result of close association with man wherever he has gone exhibits a considerable degree of cauti m intelligence and cunning in the selection of places of concesiment d m g the day. The bedhug has been known to attack human homes in broad day hight though no mally feed g at pight o in the dark While there is no convincing evidence that this insect is the usual vector of di case it has bee suspected in the transmission of kale agar tropical sore Eu opean and African relapsing fever Chags's fever of Brazil tuberculosis leprosy and pl gue Successful inoculation if it occurs in these diseases probably sults from the acc dental es mage of the causati c agent on the mouth pa to Feed ng requires from 5 to o minutes after t buch the t sect returns to its place of concealment for the 6 to 10 days conserv for digestion and molting or if in the adult stage for ovideposit. During hot weather the eggs hatch in from 7 to o days It may su vi c fo a year and perh ps even longer without food Distribution is cororoonly effected by art les ordinarily used by man such as clothing laundry and traveling accessories. Its habits ta are c acks and crevices in furniture huilds gs ships or car Ballour records that during a campaign in East Mr c hedbugs were found with a the cork I n ag of helmets. At one camp the belimits were deposited together at night and the infestation became almost general The house centipede cockroach and the common red house ant are said to he natur 1 enemics but are of little imp rtance in the control of bedbugs

End cation —A temperature of from 66 to roo F accompanied with a high relatic abund by will kill need has backed bedough with a few days and 15 F within a few minutes. The higher temperature will also destroy the eggs. Clothing and bed dung may be exposed daily to fresh air and sunkpik. Steam hot water and the blow tork are effective where they can be appl d. A bag diss fector may be readily constructed of heavy cannes. The upper end should be permane thy fooded by sexual visited in the sexual control of the control of th

S mpl meth ds of control rousst of the liberal application of kerosene benzene or any of the lighter petroleum onle eath p throe or containing 10° of crude create with or suthout the addition of turperatine and applied with brushes or by mpecting with byrages into all creverse of books i rut or "a silar lawer the in ects may be with byrages and on all creates of books in the control of the con

Badly infested quarters may require fine gation. Illidrocy at a cid gas using 5 to 10 ounces of pot a um cya. I per 1000 cubic feet with an exposure of one bour is very efficient bit must be intelligently emplored on account of the dang 1 to human beings. The filmes of burning slophur destroy the insect mail stages including the effect of value where this method is not object onable. The effective dosare

1730

may be obtained by burning four pounds of sufphur for each 1000 cubic feet of space with an exposure period of at least six hours

Ants —These troublesome insects may be destroyed by placing a ball of waste or cotton saturated with carbon basulphide in the burrows in the ground and then care fully scaline the opening with most clay

Calcium cvanide in the form of granules or dust is said to destroy effectively land crabs and ants On exposure to sur this material slowly reacts with the moviture of the atmosphere and gives off hydrog-janua card gas. The chemical is placed in the

burrows and the openings scaled with net clay Trecautions must be taken to prevent poisoning by hidrocyanic acid gas in the storing and handling of calcium cyanide Other Arthropoda—Tleas see pages 700 and 1214 Lice ee page 1741 Sand files

see page 927 Scabies see page 1493 Ticks see pages 353 and 1734

CONTROL OF NATIVE TROPICAL RACES

Whether or not he washes the white man in the tropics must come in contact with natives and especially those who work under his direction or who serve him. The following note made by Pearson and Viochett regarding the cortect attitude to was native assistants who are being trained are applicable towards any natives and may be quoted here. One can indeed tabulate the most important features of the attitude which will lead most quickly to the confidence of the natives as follows.

r Maintain a quiet manner and never fose temper

2 Be insistent as to obedience in all details. Never pass over a neglect of duty however small

3 Maintain reserve with natives Do not that with them about matters out ide

ork Never joke with them

4 Be as con iderate as pos ible but never weak

5 Never forget a promise nor make one which you may not be able to keep While living in the tropic is generally upposed to be detrim nial to the health of

white people as compared with natives statistics from everal large cities located in the tropics or subtropics show that there is a wide difference between the death rates of foreigners and natives in favor of the white race.

Simple health rules published by the Bureau of Health Manila P I are quite to

the noint and may be ob street without great difficulty

It is easier to maintain good health in the tropics than in the United States but in

order to do a you should observe the following simple ruf s

Never drink any water unless it has been either boiled or distilled nor eat any
raw vegetables. If you observe this rule carefully you will probably never contract
dysentery typhoid fever cholera or any other disea e that originates in the intestines

Disregard of this rule is responsible for the return to the United States of over 50° of the invalids who leave these islands Fruit is wholesome and may generally be eaten raw with impunity provided it is

Fruit is wholesome and may generally be eaten raw with impunity provided it is of a kind that grows upon trees well above the ground Alcoholic stimulants are not necessary the advice of old residents to the con

trary notwithstanding
Generally di case-carrying mosquitoes fly only at night therefore always sleep

under a good mo quito net
Finally observe the same hygienic rules that are applicable to temperate climates
including those of physical exercise

It may be added that the housing facilities should provide plenty of space good ventilation and be properly ser ered Veneral disease must be avoided

No family should here in remote places where good medical care is not immediately available as many tropical diseases are rapid and fatal to their action especially in children. Yearly changes of te idence to a cooler climate should be possible for both women and children.

In conclusion at may be stated that the increasing demand for tropical products both for food and for industrial purposes requires the ultimate utilization by man of the fertic

lands in the trop cs in order to provide for his own luture. As E ikman has stated Technical skill a dindustry backed by science stick at nothing where there is question of assisting man in the strug le for life. If he cannot be made fit for the climate they make the chimate fit for him. The so called temperate zone has only deserved this name a uce man has succeeded in making himself to a great extent dependent of the inclemencies of the climate in creating comfortable surroundings by means of adequate clothing the heating of his house etc. The str ggle against the he t should lead to 2 similar result though more difficult to attain Refrigeration in and outdoors a cons derable lightenin of the task of the laborers by ever more perfected implements quicker means of communication which reduce wieks to days days to hours and all that at s ch a moderate cost that it can be generally put into practice-to he sure it is not indulging in chimeras to believe this poss blity in the future. In this light the question of colonization is in the first place a technical economical problem, the solution of a high may be safely left to time. The spirit of the times so t to be checked in its progress and hymene too must go a th the current trying by reliable aformation to contribute its share in leadin at in the right direction

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DISINFECTANTS AND DISINFESTANTS

By distriction is mant the destriction of minut us factors by steriliar in the destrict on a fell luing; the ig. Germodes are substances which lill destrict producing h of ms. The term a t-stepl which has been restricted technically to those substances which are minical to the growth of haterian has come to ha example of the substance of the substances

1738 APPENDIX

Decodorants may or may not be antiseptic or germicidal. An iosceticide may or may not be a germicide and buce persu.

In disinfection we must consider

1 Strength of solution It must always be kept in mind that the strength of a germicidal solution when added to an equal amount of material to be disinfected is reduced in strength one half. Thus I punt of a 50° compound cresol solution added to I punt of faceal material has a disinfecting effect of 2 2 0% solution.

2 Time of application A common mustake i to consider a few minutes as sufficient for contact of germ-containing material with the disinfectant I in the faceca-cress mixture above noted the action of the disinfectant abould continue at least one hour.

before emptying the vessel

3 Nature of medium in which disinfectant acts Germicidal agents are much less effective against bacteria contained in material rich in organic matter than when in pure water

4 Temperature Disinfecting solutions show greater power as the temperature rises and act less efficiently in the cold. At 30 C they are active

By Coefficient of Inhibition we mean time and concentration necessary to prevent development of bacteria

By Inferior Lethal Coefficient we mean time and concentration necessary to kill non spore bearing bacteria

By Superior Lethal Coefficient we mean time and concentration necessary to kill

spore hearing bacteria

Phenol Coefficients—In determining the germicial strength of a disinfection against any given organism it is rempared with that of phenol. The Bureau of Chemitry Department of Agriculture determines the phenol coefficients of disinfections under the provisions of the Food and Drugs Act and the Insecticide Act. They are expressed as the B syphism phenol coefficient S americ phenol coefficient depending upon the organism used in the determinations. If more powerful than phenol under the conditions of test the coefficient will be greater than i. The method employed by the Bureau of Chemistry is hased on the Rideal Walker and the Hygienic Laboratory method but differs from both in some respects.

Disinfectants May Be (A) Physical (B) Chemical

(A) Of the physical disinfectants we have

r Sunlight. The red and yellow rays are practically mert the ultra violet most active. Direct sunlight kills non spore bearing pathogenic organisms in from one to several hours depending upon moisture temperature and other conditions. Exposure equivalent to go hours sunlight is usually required to kill anthrax apores.

2 Burning is effective when practicable

3 Boiling is efficinf Non spore bearing bacteria are killed almost instantly by a holing temperature but spores may resist destruction for many hours at 100 C One must remember that the boiling point is lower at mountainous elevations.

4 Steam is extremely efficient when penetration is in ured

(B) Chemical Disinfectinits — BioMorate of increasy is usually sold in the form of nutrepute tables. As a 4th interaction of the rate for the increase of the interaction of the rate of the interaction of the rate of the solution should be made in a mooden enameled or earthern ware vested. As buckloned forms never allowances at the old not be used in distriction of sputtum faces or any albuminous exercis. It must be remembered that bucklonde is a mordant so that any stanse in sucked clothing will remain permanent For dissinfection of clothing the material should be left in x-roop buckbonde for one boar. Dishes for food should never be dissinfected in buckbonde on account of the danger from pusioning. Floors and walls may be disinfected with x-roop buckbonde approach with a more of the food or walls.

app ice with a ring. Another a representation of less than 37% of formiddehyde and formiddehyde to SP contains not less than 37% of formiddehyde A 5% dilution in water (so ce so formiddehyde 930 oc water) makes a satisfactory disinfectant for soiled clothase. It is also valuable for albumnous material. The

d s ofectant must act in a strength of 500 so that if i pint of facces is to be disinfected e should add to it a 10" dl t on of the offi ral solut on and allow it to act for one hour

Funngat on with formaldchyde is employed only hen the object is to destroy bacteria as the gas is valueless as an insectic de Such fumigation i now seldom con sidered necessary in public health practice. Formald hyde is efficient as a surface d sinfectant when the temperature is above so F and the air contains at least 60" of moisture. Owing to its lack of penetration the gas is not efficient for the d sinfection of mattresses or similar articles

A con ensent method of formaldehyde fumigation is to your soo or of Solution of Formaldehyde on 250 Gm of barrum diovide or potassium permanganate for each

1000 cubic feet allow ng exposure for 6 to r hours

In employing this method take a pan partly filled this water. Place in this a second metal or glass receptacle containing the bar um do de or potassium perman ganate and paur in the Solution of Formaldehyde. The gas is generated in great amounts in a few seconds. The receptacle should be large enough to contain to times the volume of the Solut o of Formaldehad as there is a tendency for the mixture to foam over the sides of the cont 1 er

Another practical method is to ap v sheets with formaldehyde solution. The solution (37 ") should be sprayed on sho to suspended in the room in such a manner that the solution remains in small drops on the sheet "p 2, not less than o ounces of Solution of Pormaldehyde for each 1 oo cubic feet." Used in this way a sheet will hold shout 5 ounces v thout dripping or the drops running togethe. The room must be sested very tightly in disinfecting with the process and kept closed not less than twelve hours The method: I mited to come or apartments not exceeding coo cubic feet The formalin may also be sprayed pon th will floors and objects in the room

Plenol -It is soluble in water to the e tent of about 50 and in such strength it;

an efficient disinfects t The solution should be made with h t water

In standardizing de of ctants phe of is used as the standard. It is expensive however and there is often diffculty in mak g up satisfactory solutions. More efficient a d mo e convenient is the Liquor Cresol's C p situs LSP. This may be prepared by mixing equal parts of cresol and soft soap. This has a value according to tests mad in the Hygen c Labor to y f 3 making it in tests without organic matter three times as efficient as phenol. Under a mil. co ditions lysol had a value of 2 2 creolin a 25 a d t ikresol of 262

Fouri pa ts of a 50" solution f Liq C esol Co and the fa ces urine or sputum to he d si feeted is satisfactory for disinfection pro ded the mi ture is allowed to stand for one hour. He we ould have the effect of a 500 solution. Liq Cresol Co (50") is an excell nt d infectant for contami ated bed clothing etc. It is also most suitabl for the disinfection of floor and walls Sulplate (Copper -The salt in dlut as fr on ooo to ooo ooo has a remark

able destructive effect on certain species of all ae up a smalls and larvae of Anotheles Hyd oze Dioxid -A " solutio will bill anthrax pores in three hours. It is useful in treatm nt of anaerobic infects as as at the gas bacillus. When hydogen droude is used in the p esence of blood or pus the catalase if the latter rap div decom poses the HO s that the d supfecting po pidly disappears. The g abity of hydrogen peroxide cann t be dene ded uno on account firs rapid deterioration

L me-It must be remembered that air slaked lime is mert as a disinfectant For disinfecting faeces freshly prep red mill, of time is e cellent. It is made by mixing unslaked lime with four times its volume of water. An equal quantity should be

added to the facces to be d s nfected

Chlo snat d Ls - This can be purchased in air tight containers and when the fail to yield 30 " of availabl chi rine (the USP req irement)

For a working d nf ctant solution a ld a pound to a gallons of water allow insoluble matter to settle and do ant the clear ha d Thi is satisfactory for m pping floors and for disinfecting facees, p tun nd un e equal parts of the e creta and d sinfecting solution being mi ed and llowed to stand for one hour

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Chlorine -The use of chlorine in the disinfection of dranking water has been con

sidered above see page 1720

Eutel—A solution containing o 27% hypothlorous acid and known as eusol has been highly recommended in the treatment of gas gangrene wounds. To make it put 12 g grams chionnated time (bleathing powder) in a Winchester quart fasks and cover with a liter of water. After thorough shaking add 12 g grams of bore and After again shaking the mixture should stand for a few hours and then be filtered through cotton wool. The clear solution is cured. It must be kept in tightly closed bottles.

Chloromine T —This chloring antiseptic is more stable than hypochlorite solutions and can be used in greater concentration. It is non towa and readily soluble in water It is usually used in 2°c solution in the treatment of wounds. Cause which has been impregnated with a 5°c solution and direct can be used in light packing of wounds In the eve of "(1-spood) in Physiological Salah es efficiences and non-instantial in the eve of "(1-spood) in Physiological Salah es efficiences and non-instantial

Dichloramine T.—This like chloramine T is a crystalline substance but is practically insoluble in water. It is a very active germicide. In use it is dissolved in chlor nated eucalyptol or better still chlorinated paradiin wax (chlorcosane). For treatment of infected wounds it is used in 6.5 to 100" strength, the chlorinated oil solution of the

antisentic being sprayed on the wound of rause covering the wound

Arriforms —Of the dyestuffs recommended as germicides this is better adapted to the purpose than mislachit green or brilliant green. Arriforms or faunce as it is also called acts more efficiently in serum mistures than in aqueous ones and is less injunous to tissue than most other antispites. It is generally used in 1-roos solution in salt solution and makes a good wet dressing when cause is soled in such a solution.

Dakin's Solution —The best known and most widely used of the disinfectants of the chloring group is a neutral sodium hypochlorite solution called Dakin's solution. This contains not more than open of less than out 30 AOCC in a neutral solution

The usual method of prepaing Dalan s solution is to make a 14" solution of anhydrous Na₂CO₂ and alondy introduce chlorine gas from a cylinder provided with a flow meter adding 48 Cm or 1600 cc of gas per later of solution. To litrate remove oc ca add 25 cc of 1 ater 5 cc of 10° N 15 solution and a cc glacul acetta and Add from a burette Nylos oddium thosulphate solution until brown colors adscharged Amount should be from 12 to 134 cc. If necessary dilute with 14° Na₂CO solution. Test reaction with phenopolibible in a skeprible bloom.

The following method of preparing Dakin a solution was formerly used in the chemical laboratory of the Naval Medical School and is recommended if chlonic gas in cylinders is not available

(A) Bleaching ponder 100 Gm
Water 100 CC
Shake to mix thoroughly
(3) Sodium carbonate 45 Gm
Sodium bicarbonate 48 Gm
Water 2000 cc
Dissolve completely

Mix A and B and thake vigorously for 5-to mustets or allow to stand in a closed container a few hours. Then filter. This filtrate is the Dakin's solution which the neutral to solid phenolphthylem (flash of red with alrobodic solution), but will contain about to 6 to three times the amount of NAOCI required. Determine exact per cent of NAOCI and dishite to proper strength as follows.

"I've co of the filtered Dakin a solution in a too oc volumetine flask. Add so co of 10°, KT and a co of cleated actor and Dakit to mark suth II() and must thoroughly. Put this sunc-colored solution in a burette. In Erlenneyer flask put 5 co of Mylo sodium thousphalate (14, 60 m has 500, 410 por late of 10) and add a co of statesh paste for an undicator. (The starch paste is best made by muning 1-o C m of starch with about 10 cc cold water and pouring this into poce of boling water). From

the burette run this solution into the 5 cc of thiosulphate unitf a faint blue color results. The is the end point. Take the reading on the burette and calculate the per cent NAOCI as follows.

Calculat on

 $\frac{\text{r8 6 5}}{\text{cc of solution from burette}} = \text{per cent NaOCI}$

per cent NaOCf = the number of cc of above solution req. 1 ed to dilute to

Example

ag cc of solution from the burette were required to reach the end point

1865 = 064° NaOCI

 $\frac{50}{0.04}$ = 77.88 cc So take 77.88 cc of the Dakin's solution and dilute to roo cc

This will give o 300 \according the required per cent Equations involved in the above are as I llows

> Cachoch + Na CO = NaOCl + NaCl + Caco NaOCl + HC H O = HOCl + NaCl H O zkI + zHC,H O, = zHl + zkC H O HOCl + zHI = I + IHCl + H O I + N S zH O = Na S O, + zNaI + zNH O

DISINFESTANTS

By disinfestants we mean those agents used for the destruction of rodents and 1 sects

Gascous D sinf stants

Among the funngants effective against both odents and a sects we have sulphur dovide hydrocyan acid g s Zyklon B hich was authorized for use in the Public Health Service in 1926 and evanogen chloride gas These are destructive to all forms of animal life. Hisdrocyanic acid g s a d cyanogen chi nde ga do not injunously aff of mercha dise to the etc and require less tim for exposure than sulphur dioxide Alth ugh sulphu dioxide has the manifest disad antages of rotting fibres of textiles and bl achi g certain dyed f brics its salety of application mak a its use preferable to c) an de i migants by those mexperienced in furge scale furnization. Prior to furniza tion of vessels the crew huld be mustered and all ab entees accounted for in order that n ne might remain in the compartments to be furni ated. Thereafter measures should be taken to p event the entry of a v unauthors ed person to such compartments until the medical officer has pronounced them safe for occupancy. In fumigating for rats a check is made after fum e t on t insure that no rats em in all e ff necessary fumigation is repe ted. After fumigation h teles ventilators d is etc are opened I m the outs de The P bire Health Service uses Aerothrusts (portable gasoline motors with irplan bi de f ns to remo e the g s from h lds and spaces h ving poor entil tion) They do not enter the superstructure for at 1 ast 15 m nutes after open ing up and do of enter the holds at I they have been open an hour. In add tion a tame rat in a cage is lowered to the bottom of the h ld and l ft for at l ast five minutes to test for hydrocyanic acid gas or cyanogen chlor deg 3 If the rat is unaffected the medical officer goes personally on beers a one of h men go through all the compart 1742 APPENDIX

ments before they are declared safe for occupancy. Men doing this carry an anticyanide gas mask in the alert position are equipped with searchlights and are watched

from the deck

Sulphus Dazude—Tor destruction of raits 5 pounds of roll or sublance sulphus
are burned per 1000 cubic feet of space bhallow pans should be used for the sulphus
which is spranked with alcohol and gented. Precautions should be taken against
fire by elevating the pans by means of bracks etc. in a larger vessel containing water
Exposure for six hours is necessary. Two pounds of sulphus per 1000 cubic feet with

which is sprinkled with alcohol and genited. Precautions should be taken against fire by elevating the pans by means of bracks set: in a larger vises clontaining water. Exposure for six flours is necessary. Two pounds of sulphur per 1000 cubic feet with two hours exposure are sufficient for destruction of mongitutes whereas for hody lice the period of the period of the period of the period of the period of the discute may be employed noticed of homore spaces are required. Luncified sulphur discute may be employed noticed of homore passes are required. Luncified sulphur absolution of the period of the period of the period of the period of the period of sulphur discuted by the sulphur Machinery may be projected from the artist of sulphur discuted by conting the metal parts with lubreating gress. If clothing is washed immediately after sulphur furnigation the rotting effect will be lessened.

Hydroxymic leid Gas — For destruction of rats 5 ox sodium examile of high purily 32 ox sommercial sulphuse (and (661)) and 100 ox water as required for each topo cube feet of space. Proposer for two hours is necessary. The water as placed in a crost and the acid is run in calitotoly immediately before fungation in order to take advantage of the heat generated. The sodium cyam be contained in a cloth high is dropped in the diluted seed by an operator who we care a special anti-grained gained gas mads. The ordinary military gas mask does not protect a gaunst hydroxymic acid gas and canone chloride. Sodium examile eggs of the proper weight are to be preferred to the loose cyamide. Liquid hydroxyame and in cybinders is siften in but dangerous to trais operating of the control of

The Public Ifealth Service now use Lyklon Discoids (a trade name of American Cyanamid & Chemical Corporation) These contains 3 per cent chlorycen (a lacrima tor) with IICN absorbed in paper pulp which is cut out in the form of thin discs

Two ounces HCN per 1000 cubic feet of space are used

Cyanogen Chloride Cas — This gas has been used as a substitute for hydrotyams send gas. It sherly matory and mritant properties even in non lethal concentration are efficient to wars of its presence. It does not squire foodstuffs textiles etc. For fringigution against rats the Public Health Service has employed, 40 a sodium cyanode of 8 to 1 60x sodium chlorate (eased amount varies with one itions not yet determined). The calc and sater are mixed in the cased and eye of water per 1 root could refer of space. The calc and sater are mixed in the mixed by many facilities and a state are mixed in the mixed by men watering and to state gas masks here containing a mixture of sodium granted and sodium chantle and chantle gas masks.

chased and will obviate the hazard connected with mixing the loose chemicals

Pulicides—For destruction of rat fless one must accomplish the simultaneous

destruction of rats by lumigation but poison trapping etc

Among the liquid pulicides we have (r) crude petroleum (fuel oil) which is at times called Pesternic (2) an emilsion of Lerosene oil made as follows. Lerosene oo parts soft soap r part and water 5 parts. The soap is dissolved in the water by the aid of heat

and the kerosene gradually stured min the hot muxture

As a general entertación a maximo of o 3 per cent pyrechtum (estern of the monovalent and dualent chryanthemum acadó and z 5 per cent B II thou, anodethyl tel (5 per cent Lethane 38 a trade name of Robin & Hans for 50 per cent Dy volume of the alphatus thou, canacity local observed krosses as a very efficient fluidu insecutión (sprav). As a supplement to the spray a mixture so an hert carrier (suplaur tale (sprav). As a supplement to the spray a mixture so an hert carrier (suplaur tale occide) of pyrethrum ponder and pondered derisa er orbe as such proportions as to give a content of o 4 per cent pyrethrum and x per cent roteome yields a highly successful meetingle powder.

Carb xide gas (a trade name of Umon Carbide and Carbon Chemicals Corporation) which contains to per cent ethylene oxide in carbon dioxide has been found useful as an insecticide when employed in the concentration of 6 pounds per 1000 cubic feet of space The period of furnigation required is 3 hours (for a sealed space) (See also D 700)

Pediculicides -Owing to the great impo ta ce of lice in transmitting typhus fever trench fever and relapsing fever their dest uction a vital consideration

Althou h the body louse is the important t a soutting agent the head louse and poss bly the crab louse should also be dest oved

The subject of pediculos: has been much d seussed on account of its importance among the troops in the World war

F the destr is on of head lice Pernet recommended

r Prevention hair to be kept close r pped and clean

2 For the nits wipe them off with a solution of in 30 ph ol

3 For the lice themselves. Unguentum hydrargym ammoni ti diluted (gr z to z o) or any fatty sticky body well rubbed into the back of the head Paraffin lamp ol (kerose e) also good but not to be used near an open flame or I ght

Blanchard considers camphorated al ohol or varm vinegar containing 1 to coo corrosive sublimate as useful for head free He also suggests the fum cation of clothes with tobacco as valuable for body lice

For the d struct on of b dy I co P net recommends

I All body and b d lines and clothes should be baked o sterrized by bo ling 2 Unguentum staphisage as should be applied to neck bands of vests and shirt in

the region of the neck

3 Alkaline baths to sootbe the irritated skin Sublim d sulphur or naphthali e sprinkled in the bed a d the clothes is very useful Castell m and I can be see gone most e tens elv into the matter of louse destruc Their conclusions are as follo s In regard to sold and I quid insecticides the substances which have been found to be deleterious to body lice are in the order of their

efficiency kerosene oil vaseline guaiacol ani e preparations sodoform lysol cyllin

and similar preparations phenol solution in phth lene camphor Pyretbrum has a cry feeble act n on tice and boric acid aulphur corrosive sublimate and zinc sulphate when used in powder form have apparently no action whatever As regards bedbugs herosene oil is the be t in ecticide. Ne t to it comes gustacol o e of the most active drugs of these tred

For ridd g the body of lice it of it a gaseps are essent at

The har of the body and head should be choped 2 The subject should be bathed the e be g u ed f cely kerosone emulsion soap prepared by boiling part of soap 1 4 pa to of water and then add g 2 parts of kero se e oil. The resultant jelly when mixed with a parts of ater makes a liquid soap that is convenient to use and which may be applied effects ely

3 Following the bath the body may be amounted with kerosene special care being de oted t the barry parts Skin irritation may b I Guire early removal of the

4 It has been found that I ce on clothing remo d from the body may emain alive n ne days and their eggs as long as f 13 da s. The cloth g therefore should be di infested by one I the followin methods

(a) Steam (b) boiling for five minutes () 5er compound c esol sol 110n for 30 m nutes (d) f migants such as sulph doude and hydroc) anic acid g s Chlorpicin has also been employed

5 In the absence of facility s f r carrying out 1h steps d scribed or to prevent infe tat on subsequently dusting powde s a e sometimes used. Of these the NCI powder containing c mmercial n phthal ne 96 Gm ces te 2 cc and iodoform 2 Gm is the most widely known but Moore's powder-creo ote 1 cc s lobur o c Gm and tale 20 Gm-15 less ; stating a d 15 52 d to b say times as effect e It has also been recommended to wn out the underclothes in 5° compound cresol solut n and then dry thorou hly or to imp egnate them with substances such as the h logenated phenols

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ments before they are declared safe for occupancy. Men doing this carry an anticyanide gas mask in the alert position are equipped with searchlights, and are watched from the deck.

Hydrocyanic leid Gas - For destruction of rats con sodium examile of high purity 736 oz commercial sulphuric acid (66B) and 10 oz water are required for each tooo cubic feet of space | Exposure for two hours is necessary | The water is placed in a crock and the acid is run in cautiously immediately before furnigation in order to take advan tage of the heat generated. The sodium evanide contained in a cloth bag is dropped in the diluted acid by an operator who wears a special anti-cyanide gas mask ordinary military gas mask does not protect against by drocyanic acid gas and cyanogen chloride Sodium evanide ergs of the proper weight are to be reclerred to the Liquid hydrocyanic acid in cylinders is efficient but dangerous to transloose evanide I or generation of IICN for destruction of insects Creel and Paget employed materials in the following proportions potassium eyanide r part commercial sulphunc acid (66B) 2 parts and water 136 parts by neight. The following amounts of potassium cyanide per tooo cubic feet of space were recommended for mosquitoes o 4 ounce 15 minutes exposure for bed bues a ounces exposure for one hour for body lice to ounces two hours exposure for reaches to ounces one hour exposure

The Public Health Service now use Zyklon Discoids (a trade name of American Cyanamud & Chemical Corporation) These contain 5 per cent chlorpicin (a lacrima tor) with HCN absorbed in 1 aper pulp which is cut out in the form of thin discs

Two ounces HCN per 1000 cubic feet of space are used

Cyanagen Chloriat Cas — This gai has been used as a substitute for hydrocyans and gas. Its lately matory and arritant properties even in non-lethal concentration are efficient to 1 are of its presence. It does not injure foodstuffs textil etc. To trimgstation against rats the Public Health Service ha employed 4 oz sodium chloriate (excet amount varies with om itions not jet determined) are or commercial hydrochloria and and ry or of water privoce cubic features that you consider the control of th

chased and will obviate the hazard connected with mixing the loose chemicals
Pulicides —For destruction of rat fleas one must accomplish the simultaneous

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Among the liquid pulicides we have (1) crude petroleum (fuel oil) which is at times called Pesterine (2) an emul son af kerosene oil made as follows. Kerosene 20 parts off soop 19 part and water 5 parts. The soop is dissolved in the water by the aid of heat.

and the kerosene gradually stored into the hot mixture

As a general suscensed a mixture all a pier cent pyrethinus (siters of the monosalent and disalent chrysanthenum acids) and s per cent B B thorey anotherly letter (p per cent Lethane 384 a trade name of Robin & Hass for 50 per cent by volume of the alighbatic thorograntic) in declored lerosene is a very efficient biqued insection (sprav). As a supplement to the spray a mixture in an inert carrier (subbut take of each) of pyrethirum powder and powdered derivan crube in such proportions as to give content of 0.4 per cent pyrethinus and 1 per cent rotesone yields a highly successful insectingde powder.

The fumigants usually employed to destroy mosquitoes are dry sulphur dioxide pyrethrum and Mim's culicide (phenol camphor) The U S Public He lth Service

has also used hydrocyame acid gas for this purpose Dry sulphur d onde produced by burning 2 pounds of a liphur for every 1000 cubic

feet is very effects c if the spaces are made tight by stuffing or scaling all cracks and openings To a hours exposure is sufficient. The essels in which the sulphur is to he burned should rest on bricks or in a tub of sand to p event fi e but should not rest in water as is done in ord nary fumigation. It is said that in the abse ce of moisture sulphur dio ide causes no injury to household goods fabrics or metals

Pyrethrum is u cd in the proportion of a pounds to ooo cuh c feet. The powder is ignited and after two hours exposure the mosquitoes must be s ept up carefully and hurned as pyrethrum although it stans the mosqu toes cannot be depended on to kill

The e pense is another deterrent to its use

Mim's culcide is made by triturating equal parts of camphor and phenol. The result g knowd is volatilized by gentl heat 4 ounces being used for each 10 o cubic feet Goldherger states that like py ethrum the fumes of this culicide at n but do not necessarily kill the mosquitoes. Care should be taken not to overheat this substance as the vapor is likely to eatch fire. The I mp us d to heat the contain r should stand in a vessel of water for this re son. In the ab ence of a convenient support a piece of sto en pe is cut to form three legs. An alcohol lamp is naerted to heat

a flat basin resting on the other end of the pipe

Creel and Faget found that exposure for 15 ms utes to the gas from 0 4 ounce of potassium cyanide per 1000 enbic feet of space was suffic ent to kill mosquitoes. The amo at for 1000 cubic feet yields approximately part cyanogen to 6000 parts of air so dil te in fact as to practically elim nate all danger to human life. On repested occ sions we entered the furns ating om immediately upon opening the doors after mo quito fumigation without n t ng any ill effects lo gen ratin, the hydrocyanic acid g s they used p t s um cyanide cp sulphuric acid (66B) and water combined in the p oportions by weight of 1 part evanide 2 parts acid and 236 pa ts water

For houses that cannot be so eened pr perly by re son of their construction Coogle found comme ci lere s to 0 to be pract c las a repellent for an pheline mosquitoes The ce h gs and walls of 25 houses in various sections of an anopheline infested area were sprayed in the proports n f gallon of creosote olt 4 o square feet Anophel ne m squitoes were four d n all the houres on sereral at sprior to the treatment. After spraying no anopheline mosquitoes ere found in any of these ho ses during three inspections at thre we ke inte vals. App rently the occupants did not object to the creosote o l and no ill effects were n ted n any of those who slept in the come subse-

quent to the sprays

Volat le oils particularly citro ell pennyroyal lavender and cedar are commonly used on expo d p rts of the body as repellents Spirit of camphor kerose e oil of peppermint oil of tar lemon juice a d ne ar ha e also b en recomme ded S motz recomme ds d lut n w th 4 p rt of liquid petrolatum to retard the evapo ation of oil of citronella Rep lients to be applied to the body a e poor substitutes for screen a wh n we have to do with fective mosquitoes

COMMUNICABLE DISEASE CONTROL ON ADROPAGE

Following the action of an Internation 1 Convention for Aerial N vigat on at the Hague in 933 regul to a conce g measures to p event the nired ction of com m nuable disea s h e been establish d As regards pa se gers these follow the l es adopted for other modes of transportation. The c unmunicable d seases which re the subject of spe | 1 m su sae plague cholera yellow fever exanthematous typhus and small p | I these regul t s the period of meuhation is recke ed as foll ws 6d ys fo plague 5 days for cholera 6 days fo yellow fever 12 days for typhus and 14 d ys for small p Pe rat at on and disinsectization measures are prescribed when ind cated

Mosquito Destruction .- A: cr ft from tropical countries are required to take steps t destr y mo quitoes hefore arra al at a United States port This is accomplish d by

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Raticides - For large scale extermination of rats especially during an outbreak of plague fumigation with sulphur dioxide hydrocyanic acid gas or cyanogen chloride gas is the most efficient method. For exterminating rats and in this way second arily the rat fleas besides the ordinary poisons such as As P etc. Rucker has recom mended a posson composed of plaster of Paris 6 parts pulverized sugar r part and flour a parts. This mixture should be exposed in dry place in open dishes. Fo attract the rats the edge of the dish may be smeared with the oil in which sardines have been packed Phosphorus is the base of many of the commercial rat poisons. Its inflam mable nature is a drawback. Furthermore rats sooo learn to recognize its odor and refuse to eat food containing this poison. Barum carbonate is highly regarded as a rat poison having neither taste nor odor. It is mixed with meal and bacon fat-about a part of barium carbonate to a parts of meal. In transping rats one should frequently change the type of trap and always allow the traps to be placed about the storehouse without being set for a day or so to accustom the rat to its harmlessness. Again they should be handled with gloves so that they may not carry the odor of man. In the use of apring traps every effort should be made to disguise them by covering with saw dust stran chaff or meal Bacterial vaccines as the Dany sz virus are not considered satisfactory and are dangerous as possible causes of food poisoning in man

Larricides -When drainage and filling of mosquito breeding areas are not practi cable and the use of fi b not possible vanous larvicidal agents may be used. The most common of these are petroleum both crude and refined Panama larvielde (p 1734) crude phenol cresol and a mixture of soft soan and petroleum. Thosy me thylene (paraformaldehyde) has been mentioned by Roubaud and others as being efficient against anopheline larvae The Marine Barracks at Quantico \a reported satisfactory results from the use of oiled sawdust in 1018 Bather and Hayne published an account of the use of Paris ereen mixed with inert dust to form a surface deposit in 1921 The observation that Pans green is effective against the surface feeding anophelines but has no effect on culcine larvae has been confirmed by subse quent observers One pound per acre is efficient and in open water without vegetation much smaller quantities suffice. Airplanes equipped with hoppers lend themselves to thorough and economical distribution of larvicides The Department of Agriculture tried dusting with Paris green from airplanes manned by Army pilots in 1923 that time airplanes have been used in vanous parts of the country to distribute Paris green and oiled sandust. Oiled say dust is probably the best general larvicide for use in this manner. Dry fine say dust is impregnated with a mixture made from equal volumes of crank case oil and kerosene It takes four to ten days to effect satura tion depending upon the kind of sandust used. Excess oil is permitted to drain from the impregnated sawdust before it is used

Destruction of Mosquitoes — Measures of protection against the immediate danger of infection from the adult mosquito ment attention Screening furnigation repellents

and exatting constitute the usual means

"An extra stated that were exceening with 16 meshes to the linear inch will evolute anophelines. Sumber 18 streets (18 meshes to the inch) was adopted in the Ishmus to exclude Aeles aeryph which may pass through number 16 street. It is manifest that screening will not be effective unless particular attention is go en to stopping tracks around the doors window screens and elsewhere. Holes through hich pipes are stated in the street of the pass drains freplaces not in use and even key holes should be seal d against mos quitoes. Canvas strips were found by von E doof to be convenent in making window screens and screen doors tight. In quarters for temporary occupancy first electronic market where screening is not possible mosquito bear for temporary occupancy for electronic was also bear to the street of th

^{*} Russell (1940) has used successfully water instead of dust for dilution

The funigants usually employed to destroy mosquitoes are dry sulphur dioxide pyrethrum and Mim's culicide (phenol-camphor) The U S Public Health Ser ice

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Dry sulphur dowide produced by burning 3 pounds of sulphur for every 1000 cube feet is very effective if the paces are made tight by stuffing or scaling all cracks and openings. Two hours exposure is sufficient. The vessels in which the sulphur is to be hunted should rest on bricks or in a tub of s and to prevent if a but should not rest in every a six date in ordinary feminestom. It is said that in the relate of monitore in the product of the product of the product of the prevent in the product of the product

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The expense is another deterrent to its use

Mins colorde is made by into sung equal parts of camphor and phenol. The resulting high off working high grade heat, a quasies being used for each ione cubic feet. Goldberger states that, like pyrethrum, the funces of its cubicde stup hot do not measurably full the monquitoes. Care about the taken not to overheat this substance as the vapor is highly to catch fire. The lamp used to heat the container sho lid stand in a vessel of water for this reason. In his ab once of a convente it support a pice of stovepine is cut to form three ligs. An alcohol lamp is inserted to hest a fit has a retting on the other end of the nine.

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Notice that the straying was the stray of th

CONSTINCABLE DISEASE CONTROL OF AIRCRAFT

Foll g the action of an International Converton for Arral Navagation at the Higgser 1031 regulator 5 concerning measures to prevent the article citizen communication drom on munication drom the communication of the manufacture of the manufac

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1744 APPENDES

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and swatting con titute the u nal means Carter stated that were screening with 16 meshes to the linear inch will exclude anophelines Number 18 ser en (18 meshes to the inch) was adopted in the fithmus to exclude Aedes accepts which may pas through number 16 screen. It is manifest that screening will not be effective unless particular attention is gi en to stopping up cracks around the doors window screens and elsewhere. Holes through which pipes oass drains fireplaces not in use and even key hole should be sealed against mosquitoes Canvas strips were found by von Ezdorf to be convenient in making window screens and screen doors tight Io quarters for t imporary occupancy fine cloth netting nailed outside the windows and secured with battens will do areas where screening is not possible mosquito bars 20 mesh hobbinet should be u ed on beds but must be properly applied to afford protection. They should be su pended so that they hang some distance o er the mattress and maide the head and foot pieces of the bed so that the edg s may be tucked in snugly under the mattress wh n one goes to hed Howard states that the wearing of veils and gloves after sundown enforced at stations on the Italian tailroads some years ago resulted in a great reduction of malana

^{*} Russell (1940) has used successfully water instead of dust for d lut on

a new macettacide sprayer a shich obvastes difficulties previously experienced and renders the process sample and effective. From proteithrum across loss such the quantermaster US \(^1\) has proved most effective. Insect repellent \(^1\) of \(^1\) is 2 is this hickanelid \(^1\) annual factor of \(^1\) he \(^1\) and \(^1\) he \(^1\) and \(^1\) he \(^1\) he \(^1\) and \(^1\) he \(^1\) and \(^1\) he \(^1\) he \(^1\) and \(^1\) he \(^1\) he \(^1\) and \(^1\) he \(^1

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- Parts green in Malaria control 11d Med Ga 75 740 1940
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spraying a cultride inside the aircraft compartments which must not be toxic to human beings. Furthermore it must be noninflammable.

The essentials of the spray formerly advocated were one part of pyrethrum extract in oil and four parts of a light oil or earbon terrachorde. The pyrethrum extract is such that one gain of the extract continues the pyrethrun extracted from no posit of attendard pyrethrum flowers the latter containing at least 0.0% of pyrethrum six determined by chemical assay. The light oil is one approximating the characteristics of kerosene and may vary within considerable limits provided the flash point is not too low.

The muture may be made up in any proportions of extract oil and carbon iterachioned providing only that the extract set alreat root? For example 1 may have a facilities upon the following a part of extract with a parts of oil 1 part extract 1 parts oil and 1 part extract 1 parts oil and 1 part extract 1 parts oil and 1 part extract 1 part of oil and 3 of extracts 1 parts of oil and 3 of extracts 1 parts of oil and 3 of extracts of parts extract 1 parts of oil and 3 of extracts of parts extract 1 parts of oil and 3 of extracts of parts of oil extraction of the state of the set of the state of the set of the se

Any of these mixtures when sprayed through the air in the form of very fine droplets in the amount of seconer thousand cubic feet of space will fatally notion monorities.

ithin 5 to 10 minutes

The action of the pyrethinn on mosquiters and probably on other insects is due apparently to direct absorption following actual netting of the surface by the pyrethinn in solution. It is for this reason that it is essential that at [1231:307] of the mattere be an oil that does not immediately evaporate. If 1007 Carbon tetrachlonds is used with the same pyrething content the lethal effect is much less presumably due to the rapid evaporation of the carbon tetrachlonde and the consequent precipitation of the pyrethinas in Solid form.

There has been objection made to the use of cashon tetraciloride by some of the avaiton executives. Furthermore it is as suggested that a combination of pyrethm and rotenone might be more efficient and more cubicable than pyrethm alone. Rotenone is a white crystaline compound obtained from derris and other plant source. The durstions ha e recently been studied by host Surgeon General C. E. Williams of the durstions has exceeded the source and a concentrated nonadismnable pyrethmisping is non recommended which has been show to be highly touc to mosquitors while practically introduction being the source of automatory of the control of the provided proceeding the introduction. South American and other foreign parts: to prevent the introduction of Anaphole combinations castern South American test to souther source of the Castern South American test is consideration and other foreign parts: to prevent the introduction of Anaphole combinations cantern South American test the southern part of the United States and prevent the introduction of any temphole from the west coast of the United States in the Hayantan Islands the present United States Public Flexible regulations require that

The operating of civils and pilots of airceaft from South American ports shall be instructed that doing flight fifter taking off from the last foreign port and before arming at the first American port and also after leaving any. United States on the last foreign port and before arming at the first American port and also after leaving any. United States insulated the port of the state arming at the first American port and also after leaving any. United States continental port each stream spray which shall contain not less than four tends per cent pyrethinas and not less than five reports or every thousand cubic feet of space and that during such praying all operangs into the aircraft shall be closed and held closed for a period of not less than five municiate paying is completed. In the event that during such plais to carry out afequate dismentization is here prescribed such dissipational and an arministration of the properties of the dismensional properties of the dismensional properties of the dismensional properties of the dismensional properties of the dismensional properties of the dismensional properties of the dismensional properties in the dismensional properties of the dismensional properties in the dismensional properties of the dismensional properties of the dismensional properties of the dismensional properties and the dismensional properties of the dismensional

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